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CONTENTS.

An Asterisk (*) denotes an illustrated article.

Notice from the Publishers..... 593

OFFICIAL NOTICE—

Annual Meeting, Western Gas Association..... 593

EDITORIALS—

Briefly Told..... 593

Secretary Littleton's Second Notice—Annual Meeting of the American Meter Company—Removal—Director Windrim and the Stokers at the Ninth Ward Works.

Fourth Annual Meeting, Southwestern Gas Association—Official Report—Concluded from Page 567..... 594

Second Day, Morning Session—Regenerative Benches in the Southwest by Mr. E. A. West—Discussion—Second Day, Afternoon Session—The Commercial Possibilities of Gas, by Mr. Thos. D. Miller—Discussion—The Question Box—Adjournment.

An Experience in Purification, by Mr. T. A. Bates..... 600

The Effect of Temperature on the Limits of Explosions of Combustible Gaseous Mixtures..... 601

Special English Correspondence..... 602

King's Choked Pipe Preventer—Lowering a Water Main *in Situ*—Differential Prices in Small Towns—Cost of Electric Lighting.

Separately Measuring Gas for Cooking and Lighting Purposes through One Meter and Service..... 603

ITEMS OF INTEREST FROM VARIOUS LOCALITIES..... 603

Some Stacey Company Contracts—Improvements at Bridgeton, N. J.—The Peoples Company's (Chicago) New Treasurer—An Effective Advertising Scheme—Consolidation at Medina, N. Y.—The Ishpeming (Mich.) Company—Improvements at Downington, Pa.—The New Works for Provo City, Utah—A Huge Exhauster—Public Lighting, Columbus, Ohio—The Philadelphia Tar Contract Sustained—The Hamilton (Ont.) Electric Sale a Fizzle—Silver Wedding—Memorial Resolutions—A Large Order for Connelly Sponge—An Interesting Suit—Annual Meeting, Rome, N. Y.—Ditto, Amsterdam, N. Y.—Cheaper Gas for Rochester, N. Y.—And Many Other Items.

The Market for Gas Securities..... 606

NOTICE FROM THE PUBLISHERS.

The offices of the JOURNAL are now located at **No. 32 Pine Street,** and to that address all communications, both to the editorial and business management, should hereafter be addressed. The rebuilding process to which lower New York is now being subjected necessitated this removal, and our former quarters, which gave shelter to the JOURNAL since May 1, 1870, are to be the site of a modern office structure. Tendering our thanks to the staunch and tried ones who so often ascended the steep staircases that led to our old-time eyrie, we beg leave to say that an Otis elevator will hereafter assist them to reach our rooms. It goes without saying that visiting gas men will, as before, be warmly welcomed.

A. M. CALLENDER & CO.

[OFFICIAL NOTICE.]

Annual Meeting, Western Gas Association.

SECRETARY'S OFFICE, WESTERN GAS ASSOCIATION, QUINCY, ILLS., April 22d, 1891.

The Fourteenth Annual Meeting of the Western Gas Association will be held at Louisville, Ky., on the 20th, 21st and 22d days of May. The Galt House will be the Association's headquarters, and the business sessions of the convention will also be conducted therein. Rooms should be secured in advance, as the indications all point to a largely attended meeting and an overcrowded hotel.

Papers on the following timely and important subjects will be submitted for the consideration of the members of the Association:

"Gas Engines; With some Practical Results and Comparisons," by E. H. Jenkins, Columbus, Ga.

"On the Removal of Ammonia from Illuminating Gas, and the Best Method for Its Accomplishment," by K. M. Mitchell, Jt. Joseph, Mo.

"On the Practical Efficiency of a Semi-Regenerative Furnace," by J. W. Dunbar, New Albany, Ind.

"Municipal Control as an Economic Factor," by Edward Lindsley, Cleveland, O.

"An Annex to a Small Gas Plant; What Should It Be?" by Wm. Tracy, Alton, Ill.

"On the Economic Results of an Electric Light Investment, Supplemented by the Author's Views of the Comparative Cost and Value of Coal Gas and Fuel Water Gas for Fuel Purposes," by Sylvester Watts, St. Louis, Mo.

"Does It Pay to Use Inclined Retorts in Small Gas Works?" by John Gimper. Leavenworth, Kas.

"An Experimental Illustration of a Simple and Accurate Method of Determining the Commercial Strength of Gas Liquors," by B. E. Chollar, St. Louis, Mo.

Next in value and interest to a paper itself is the discussion which it evokes. The Secretary will, therefore, take pleasure in mailing copies of any of the above essays to those of our members whose wish it is to look them over in advance of the meeting, that they may have ample time for a preparation of their opinion of the author's treatment of his subject. As a generous number of each paper will be printed, no one need fear that the supply will be exhausted, even though a general request be made for the same.

Application blanks and copies of the by-laws will be sent to those desiring to join the Association at the Louisville meeting.

A. W. LITTLETON, Sec'y.

BRIEFLY TOLD.

SECRETARY LITTLETON'S SECOND NOTICE.—In this issue we print a notice from Secretary Littleton respecting the Louisville meeting of the Western Association, which goes to show that the Western is as usual very much to the front. The papers promised are to be very much outside the general run, if one is warranted in making a prediction from the titles of the same. Veterans and recruits are enrolled in the lists, a most pleasing guarantee of the solidity of spirit which actuates and governs the Western. It is likely, too, that the list, already teeming with good things, will be enlarged by one or two more papers. It should be borne in mind by those who propose to visit Louisville next month, that the Falls City will have her resources for hospitality—and no other city in our broad country exceeds her in that enviable respect—taxed to the utmost. Two other conventions are to be held there about the time that the Western will be in session, and the Louisville spring racing meeting, so dear in the affection of the dwellers in the blue grass region, which one might say means all of Kentucky and about all of Tennessee,

will be at its height. All this, of course, goes to show that quarters must be engaged in advance, and with such a friend at court as Mr. A. H. Barret, of the Louisville Gas Company, to look out for the comfort of the Western's guests, aided as he is by other members of the local committee of arrangements (among whom might be mentioned Dennis Long & Co.), those who fail to be put at ease shall have but themselves to blame. Barret's word is sufficient for us, and as he has said that neither expense nor trouble will be spared—why that means that everything will be as it should be. From what we can glean the prospect is that the attendance at this meeting will far exceed any ever yet recorded in the history of the Association, whose history is that of success in the ascending scale.

ANNUAL MEETING OF THE AMERICAN METER COMPANY.—The annual meeting of the American Meter Company, which was held in this city on last Tuesday, was a very harmonious affair, a result not to be wondered at perhaps, since the reports showed that the Company had enjoyed a singularly prosperous year. In fact, the reports of the various corporations that are engaged in the manufacture of supplies for gas companies, regarding the business done by them in the twelvemonth, all go to show a most prosperous season for the gas companies. And a further indication of the continuance of such prosperity is afforded in the knowledge that inquiries from the gas companies of the manufacturers are so for this year largely in excess of those for the same period in 1890. But to come back to the American Company's meeting. The annual election resulted in the following choices:

President—Mr. George J. McGourkey.
Vice-President—Dr. W. H. McFadden.
Secretary and Treasurer—Mr. W. N. Milsted.

It will be seen from this list that the only change in the chief executive management is the naming of Mr. Milsted to the Secretaryship, vice the late Mr. William H. Down. The minor offices are held according to the allotment of a year ago. The following resolutions were passed to the memory of the Company's late Secretary:

Whereas, In the interim of our last meeting the Almighty has called from us our fellow-Trustee and Secretary, W. H. Down, therefore,

Resolved, While accepting in a spirit of Christian submission the mandate of the Divine Will, and acknowledging unreservedly that God's wisdom is for our higher advancement, we yield to His decree in deep sorrow that our earthly communion with our trusted associate, valued counsellor and tried helper is at an end.

Resolved, That we bear unstinted testimony to the great value of his labors on behalf of this Company; to the sterling honor of his character; to the sincerity of his friendship; to the manliness of his life.

Resolved, That this testimonial to the worth of our late associate be suitably inscribed on the records of the Company, and that a copy thereof be forwarded to the family of the deceased, to whom our sympathy is extended in all sincerity. [Signed] GEO. J. MCGOURKEY, Pres.
[Signed] WM. N. MILSTED, Sec'y.

MESSRS. COOKE & CO., and Mr. S. S. Townsend, who represent in New York the P. H. & F. M. Roots Company, of Connersville, Ind., have removed their offices to Nos. 163 and 165 Washington street, where they will welcome their old friends and take pleasure in making new ones.

DIRECTOR WINDRIM, of the Philadelphia Public Works, is just now enjoying a foretaste of the joys that come with the particular office which he is to control. This first particular sample of the demands that will be made upon him assumed the shape of a petitition from the stokers and firemen at the Point Breeze station of the city gas works to the effect that they are greatly overworked. They claim that they are obliged to work for 11 hours in two shifts; that the furnaces are unequal "to the task of completely burning off the coal charged;" and that because of these and other things they are obliged to lay off at least one day in each week, thereby being prevented from earning full wages. The simple fact is—and Chief Park has often called attention to it—that men physically unfit, because of age or bodily infirmity, have been put on the pay-rolls at the instance of some one with a "pull in politics." In other words, the gas works stations share somewhat with other local charities the duty of caring for the superannuated. If Director Windrim will only order a general weeding-out of the lame ducks now rated on the pay rolls as able-bodied firemen, substituting therefor men sound in wind and limb, there will be no need of increasing the force—perhaps it might even be diminished—and there is no doubt that the coal would be "completely burned off."

PRESIDENT TURNER, of the Charleston (S. C.) Company, signalizes his re-election this year by informing the consumers that the gas rate has been reduced to $1.75 per 1,000, from $2. During the period of his control the gas rate has been cut in half—from $3.50 to $1.75. And it is an open secret that every reduction ordered is traceable directly to him. He always was a firm believer in the good policy of selling gas cheaply, and even an earthquake failed to shake his belief in this respect.

[OFFICIAL REPORT.—Concluded from page 567.]

FOURTH ANNUAL MEETING, SOUTHWESTERN GAS ASSOCIATION.

HELD AT DALLAS, TEX., MARCH 10 AND 11, 1891.

SECOND DAY—MORNING SESSION.

Mr. E. A. West, of San Antonio, read his paper on

REGENERATIVE BENCHES IN THE SOUTHWEST.

Mr. President and Gentlemen:—It is with great pleasure that I am allotted the privilege of addressing you at our annual meeting in this city, and particularly upon the subject which has been allotted me, that of "Regenerative Benches in the Southwest." I will endeavor to make my remarks on the same as brief as possible, and give you the benefit of what experience I have had in the operation of regenerative benches as Superintendent of the San Antonio Gas Company.

We all concede, in the operation of the gas plant, that we are looking to that style of bench which is the most economical in operation, and I will endeavor to show you, from my short experience, that a regenerative bench is the best bench to use even in a small gas plant which produces from 50,000 to 60,000 feet of gas per day, for such has been proven to my mind. In October, 1889, the San Antonio Gas Company contracted for and put in place two half depth regenerative benches, of six retorts each, of the Mitchell patent, which benches were completed in the latter part of November of the same year. On account of the increased consumption on our part, we were obliged to fire them at once, hardly allowing them sufficient time to dry out, and almost before the stand-pipes were in position. You are all, no doubt, familiar with the regenerative bench in a general way; however, I will say that our benches differ from an ordinary bench in the following: The flues and fireplaces are all below the level of the floor of the retort room; the fireplaces are so arranged that they will admit of charging hot coke from either of the upper retorts, which fact you will concede is of a great benefit, in that it causes a decrease in the amount of coke used in the firing, and also decreases the amount of labor in the retort room. We find, by actual measurement, that we used from 28 to 33 per cent. of the coke made for firing our regenerative benches, while with the old style we used 60 per cent. Another great advantage that we find in the regenerative benches is, that they are arranged for a double set of grate bars, which can be inserted when it is necessary to clinker the fire, and which will hold the bulk of the fire up and away from the clinkers, which does not necessitate the drawing of all the hot coke out of the fire box, consequently retaining the heat in the fire box while the clinkering is being done. According to my figures and my experience with the regenerative benches, we have saved 27 per cent. of coke over and above what we would have saved on the old style of benches. Allowing as a fact, that a ton of Indian Territory lump coal carbonized will yield 1,300 pounds of good coke, we arrive at the figures that the saving alone on coke per ton of coal carbonized will amount to $1.45, considering that coke is sold at $7.50 a ton, the price we obtain in San Antonio.

Another great advantage over the old style furnace for cities where the demand for coke is greater than the amount that can be produced, is that you can fire these benches with soft coal and work them successfully, thereby saving all the coke that you make.

We all know that in firing with coal we would have to have more draft, which can be easily regulated by simply opening all the air holes and the ones in front of the furnace. In using coke for fuel, we admit very little air through the opening of the primary air flues, and still less through the secondary air flues. In this, however, you will have to be guided by the condition of your combustion chamber. I have found that, by being a little careful in keeping a small stream of water running on the two iron plates in front of the furnace, it kept the fire from clinkering, which, of course, all tends to give us better heats and more effectual work from the coke in the furnaces. Regarding the flue capacity of these benches, I can say they are a great advantage over those of the old style. In the benches that are now in operation at our works, there are 13 small pipe flues on each side of the bench which are in a perpendicular position. The primary air enters the fire box and thence upwards to the combustion chamber. The secondary air passes around these pipe-flues and thence to the combustion chamber, where the primary and secondary air meet to form the combustion, and then passing down through these pipe-flues keeping them hot, as the secondary air is hot when it meets the primary air.

We are at present contemplating the addition of another regenerative bench in our works, and I believe that we will adopt the same benches

that we have had in operation since November, 1889. We have run these benches constantly during this time, which I believe speaks well for them.

Discussion.

The President—Gentlemen, Mr. West's paper is before you for discussion.

Mr. Miller—In the figures given Mr. West states that the consumption of coke on his old style furnaces was 60 per cent., and that now on the Mitchell furnaces it is 28 per cent. We used to run our old style benches on 40 per cent. of the coke made, and the new Bredel benches were put in on a guarantee of 20 per cent. coke consumption. Since starting these latter up they have been running on 21 per cent. of the coke made from McAlester coal. These are decidedly better results than those obtained by Mr. West, and at the price at which coke sells is quite an item. The new benches at Fort Worth yielded on a test 9,000 feet to the mouthpiece, and the coke is of excellent quality. They are now running a bench of sixes with an output of 50 to 60 thousand feet every day.

Mr. Enfield—It would hardly be fair to have the names of the parties furnishing these benches published to the gas world. I know, from what I have heard from reliable parties, that the Mitchell bench does far better than the results indicated as obtained by Mr. West. He said they were down with their furnaces on a level with the creek, and could not go to the depth required by the furnaces. There is no doubt about better results being obtained in Fort Worth, as they had plenty of room for depth, and were not handicapped in this respect. This is not criticising Mr. West, for he is doing better than he did with the old furnaces. I am a little surprised at the results Mr. West gets, for I had expected better, but, of course, I can understand the case after seeing his benches. We in Dallas have got as good and better results than those Mr. West details in his paper, although we were prevented from going to the proper depth for our furnaces on account of the foundations of the old building, etc. Some of our retorts are smaller also than those Mr. West has in his Mitchell benches, yet on our smallest retorts we have averaged 7,000 feet to the mouthpiece, the month over, with a furnace only 2½ feet deep. We were then making all that the consumption called for, and with the holders full of course were not able to push the furnaces any great extent. You have all heard my results on the consumption of coke. Of course there are a great many regenerative furnaces on the market, and we cannot expect the same result under all cases, as the conditions and manner of working the same must be taken into consideration.

Mr. West—The contractors when putting in these benches wanted to go two feet deeper, but we could not do so without raising the benches and making a second floor. They told me we could not get as good results, but stated that the benches as they are built could be run on a consumption of from 20 to 27 per cent. of coke.

Mr. Miller—While I want it understood that I am not interested in either the Mitchell or the Bredel benches, I cannot see how we are to talk intelligently about benches without mentioning names. I believe the different results are owing to the different benches. The names of San Antonio and Fort Worth will very easily locate the benches, and if any one wanted to know what bench was used they could very easily find out. No evidence is considered evidence unless all the words spoken are taken into consideration. It will be as if we were trying to vitiate results in some way. We might just as well have it straight out that they were the Mitchell and the Bredel benches.

Mr. Enfield—There is this difference, if the names are published in full everybody will see them, with a probability that many may not inquire into the causes of the differences. If we publish names it becomes quicker and more easily known, and condemnation, which is perhaps not just, is likely to follow. However, let the matter go; the fact that the question as to results has been raised in this convention will lead the gas fraternity into proper and due consideration of the causes of such differences. I did not like the matter to go out without the question as to qualification being raised; now that it is raised, gas men will understand. Mr. Judge has a Mitchell regenerator bench and I would like to know what his results are.

Mr. Judge—We put in a Mitchell half-depth regenerative bench (of fives) in an old arch at Austin. The furnace is not as deep as we would like to have it, as the arch is narrow and the retorts are 14 by 24. At first we used 33⅓ per cent. of coke, but we have since reduced it to 25 per cent. The cause of our using so much at first was defective work on the old arch, and upon investigation I found that a great deal of air was leaking into flues and having a dampening effect upon the drafts, etc. By inserting a pipe into the back of the flue, I found, when we shut off the secondary air flues, the gas in that flue continued to burn, indicating that it got air other than from the secondary air flues. By fixing these flues and regulating our dampers on the uptake waste flues, we have reduced our consumption to 25 per cent. Further answering Mr. Enfield's question, I will say I get 8,000 feet to the mouthpiece, and we are using McAlester washed pea coal, which, being washed free from dirt, makes an excellent coke

Mr. Enfield—This is one of the prime questions before this Association, for it has been my hobby, as you no doubt see, to make a study of coal and its combustion. When I was little—eight or nine years of age—my great pleasure was to fire up my mother's copper wash-boiler; possibly Mr. Darney remembers those copper wash-boilers?

Mr. Darney—No, sir; I do not.

Mr. Enfield—I became a stoker for the time being, much to my delight. I like to experiment in this line, as much or more than in any other, and I think it is one of prime importance to us gas engineers, for it involves the economy of the raw material on which our manufacture is based.

Mr. Maxon—I would like to ask Mr. West if he has ever had any difficulty with too great heats on his grate bars? Is it possible to get these furnaces down so that the stokers can handle them with ease? With our regenerative furnace it is almost impossible for the men to stand before the fire.

Mr. West—When you keep steam or water in front of the furnace you can pull open the doors with your hands and you receive scarcely any heat. The stokers will take hold of the doors and remove the grate bars by hand. Are not the furnaces in Fort Worth full-depth regenerative benches?

Mr. Miller—No, sir; they are half-depth.

Mr. Russell—I have seen the benches, and think they are neither one nor the other, but are a compromise. We have in contemplation the erection of benches, but it is rather early to say what we are going to do in that line. Our results have been large in every way, but are not as happy as they might be.

Mr. Darney—The gentleman says he is manufacturing on a Kloenne bench. He saved nothing in labor, and only reduced his consumption of coke from 40 to 21 per cent. I know you can construct something on the old style bench that will use only 33 per cent. of the coke. There is a question as to it paying to put in these benches, if that is all you save, when you come to consider their cost. Then, again, they require so much more care and attention.

Mr. Enfield—Mr. West is working under considerable disadvantages, and we must give his benches credit for these disadvantages. Replying to the question of Mr. Maxon, I would say that the prime object of putting in these regenerative benches is that there shall be very little heat at the grate bars. It is as Mr. Darney says, these benches do require more care to be bestowed upon them than do the ordinary benches and settings, and there is where the rub comes in with us in the Southwest. Many of us have negro stokers, and without a foreman in the retort house all the time it is difficult to get them to work with any degree of intelligence or care. When I first put in my regenerative benches I experienced this difficulty and could not get things as I wanted them until I undertook to regulate them myself, and then asked the stokers to let them alone. I have been criticised, especially by one gas man, about my manner of regulating the air supply, etc. There is no doubt about the necessity of constant regulation, constant watchfulness with these furnaces; but when you cannot train your men to do this work with fidelity and intelligence, the next best thing is to regulate them as nearly as possible to suit all the varying circumstances. We formerly used steam under our grate bars, but the constant care necessary to keep the pipes in order and to prevent the negro stokers from breaking them by rough usage led me to fall back on the simple method of introducing water in the ash pans. The next thing I insisted on was that these men should not clinker their fires except every two days. They insisted that the furnaces could not be run this way. I insisted that they could and should be, and that they were not to clinker any fire except when I was present. Then in clinkering we cut away the accumulated clinker from underneath the hot fire, and cut it out until nothing but a thin arch of clinker remained to support the superincumbent coke; having clinkered the grate bars and cleaned off the ashes the next course was to cut down the thin arch and allow the fire to subside on to the grate bars; the small amount of clinker that was left not cutting any figure, comparatively speaking, was allowed to remain until it arched over again, when the process was repeated. We found in doing this that the grate bars were sufficiently cool to be handled with a mere glove or hand leather, and that the stoker could put his naked hand in and remove the clinkers. The result was that I got 7,000 to the mouthpiece, all through the month, on 12 by 22 retorts, with McAlester coal. You will readily see the large

gain by not drawing the whole fire in the process of clinkering. I asked my head stoker if he thought it would work now he had an opportunity to see it. He replied yes, and that it was the best result ever gotten in any works in Texas. I might add here that we could have made more to the mouthpiece if not for the fact that our holders frequently got full and we had to slack off.

Mr. Cullinane—I would like to ask Mr. West in what condition his benches and upright flues are at this time?

Mr. West—Very good. We have had to do some repairs, but nothing to speak of. We contemplate putting in another bench of the same kind, and we will have to put in new retorts in the two Mitchell benches now under fire, between now and next fall.

Dr. McFadden—Will you put in new benches complete, or tear out your old settings and reset in the same arch?

Mr. West—We will reset in the same arch.

Dr. McFadden—Are they new arches or old ones?

Mr. West—They were put in completely new.

Mr. Russell—The great trouble Mr. West seems to have is that he cannot get depth enough, water keeps him out. In Galveston, in sinking our holder tanks, we got water at 5 feet. However, I think the additional expense of going down to get depth will be repaid by the depth gained. There is no question but that the furnaces are too shallow, and much more so than the specifications call for. I do not think the benches have had a fair test, and I certainly think it will repay you to give them a good test; besides the depth gained, you will always have a tight pit by lining the bottom with concrete.

Mr. Darney—It is not advisable to go down to water if it can be avoided; it tends to reduce your heats.

Mr. Russell—That can be avoided. We cover our foundation with pitch. The only thing to overcome is the capillary attraction, which can be overcome by the pitch.

Mr. Cullinane—Mr. West's benches have been in use 14 months. I would like to ask if they have made a fair showing so far as their life is concerned. Allowing him 7,000 to the mouthpiece, they have made in that time 3,000,000 cubic feet.

Mr. Enfield—Perhaps our benches will make over 4,000,000 feet to the retort. Under the circumstances I think that is doing very well. Perhaps Mr. Darney will remember what the requirements of a retort are.

Mr. Russell—If I get 3,090,000 I am satisfied.

Mr. Darney—I do not remember what the life should be, but think Mr. West has done very well.

Mr. West—Of course, some days we would miss charges, and other days I would crowd my benches, which would make it average about 7,000 per mouthpiece.

Mr. Enfield—Mr. West's statement is not what he has given us before. He now qualifies his previous statement. I thought before, when he spoke of 7,000 to the mouthpiece, that he was giving us his maximum results as made by tests. As a matter of fact, there are many things preventing us from getting maximum results from everyday working, such as the missing of charges and the cutting down of the size of the charges in order to keep within the consumption at the time being. I do not get as much from Colorado coals as I do from coals more free in their working. When I say I can get 10,000 to 11,000 feet to the mouthpiece, I mean by this that is the best I can get at the maximum. Mr. West now says he can make more than 7,000 to the mouthpiece at times.

Mr. West—Mr. Enfield misunderstood me in some way. I did not state in my paper how much gas my benches made. Mr. Cullinane has just allowed me 7,000 feet, and asked me what I thought of it. I told him that was a very fair allowance.

Mr. Enfield—If my memory serves me, Mr. West's statement was that he got 7,000 to the mouthpiece. I am very glad he has qualified his statement, both on his own account and on account of the benches. I am very glad he can do better than 7,000 to the mouthpiece, for I think it is right.

Mr. Van Wie—I am no gas engineer, but I am led to believe that no man has yet obtained the best results out of the regenerative furnaces, and I cannot see how they can obtain the best results without getting all the heat. I maintain that a flame is a very deceptive thing. I think if more attention were paid to the placing of benches, much better results would be obtained. Often when a man sells benches he cannot get same set according to the specifications, and consequently you do not nor can you expect to get the best results therefrom. I ran the test on a bench on Youghiogheny coal. We started with a depth of 14 inches, but we found when we got down to 28 inches we got the best results. Everything that went in was weighed, and the heats were tested by pyrometers. Mr. Mitchell sells a good bench, but you cannot expect to get satisfactory results unless the specifications are followed in setting the benches.

Upon motion of Mr. Cullinane a vote of thanks was tendered to Mr. West.

A vote of thanks was also tendered to the San Antonio Gas Company for their invitation to visit the works.

On motion, the Association took a recess until 2 P.M., in order to inspect the gas works.

SECOND DAY—AFTERNOON SESSION.

The Association assembled at 2 P.M., and the President called upon Mr. Thomas D. Miller, of Fort Worth, to read his paper on

THE COMMERCIAL POSSIBILITIES OF GAS.

Mr. Miller explained that as any paper on such a subject would have to be more or less speculative, the one he was about to read was probably "more so than less," and then read as follows:

On the 9th day of January, 1891, I received notice from the Committee on Programme that a paper would be expected from me on the "Commercial Possibilities of Gas," to be read at the meeting of the Southwestern Gas Association, to be held at San Antonio, March 10th and 11th. I was very much impressed with the importance of the various subjects assigned to my contemporaries, and felt that the competency of the gentlemen who were to read papers was a guarantee as to the high class of literature to be presented at that meeting; but when I compared the magnitude of the subject assigned to me, with my ability to handle it, I am putting it lightly when I say I was appalled.

My thoughts dwelt upon the subject with a sort of fascination which I seemed unable or unwilling to overcome. I was sitting at my desk by the open window, and so deeply absorbed did I become in my reverie that I noted not the flight of time, until a sudden chill reminded me that it was dark and turning rapidly cold. Next morning I was pronounced quite ill, and have since learned, delirious with a severe attack of pneumonia.

Some five weeks later, I returned to the office and found that programme on my desk where I had left it. Then it all came back to me, and here it was the middle of February. The greater portion of the past five weeks seemed a perfect blank, and still there was a faint outline of a recollection which I could not place in any other period of my life. As my strength returned, I gradually recalled my experiences of that unremembered four weeks of delirium, and in the hope that they may be of interest to you, I have transcribed them to fill the vacancy on the programme caused by my failure to prepare a paper.

I will not burden you with the thread of my life that I had passed, but take it that I am a man who has seen his four score and more. I am looked upon as one of the old landmarks in my native place—one that has been connected in some way or other with all the improved appliances now in common use in the year 1941.

A tall, slender, blue-eyed boy, in whom I take a great deal of interest, from which, I judge (as my memory is not very clear on this point) he is in some way related to me, perhaps a grandson, announces that I must take him out to-day, and show him the origin of all our household and commercial conveniences. To this I consent as it is a delightful day in June. We are soon walking through a beautifully paved and shaded street, when the boy asks what those large plates of iron are in the street. I tell him that 50 years ago it was the popular belief that streets were for no other purpose than a thoroughfare for vehicles, but now that was regarded as only one of the uses to which streets were put, and the iron plates only covered the openings to the conduits which were as essential, if not more so, than the paved portion before him. These conduits perform a large percentage of the transportation about the city that formerly was done on the streets' surface.

In those tunnels (as we used to call them) you will find the pneumatic tubes, through which we receive and send packages; light wires, power wires, light, heat and power pipes, cooling pipes, water pipes and telephone wires. I noticed one of the inspectors about to descend through one of the manholes, and indicating our desire we followed him into the conduit. We were only a short distance from one of the central stations and in that direction we bent our steps. Our way was lighted by electric lamps stationed at regular intervals, which were manipulated by the inspector, keeping one lamp in the rear and one in the front lighted all the time. We soon came to a large area which was the basement of the station.

We ascended to the upper floor, where the men were engaged in filling, by machinery, large retorts with broken lime rock; others were charging with coal similar retorts, arranged in stacks with from 20 to 50 retorts to the bench; further on were retorts into which crude oil was

being introduced by means of steam jets, and still further down were large cupola-shaped stacks into which steam alone was being introduced, while others of similar construction were being charged from the top with black, porous spheres, specially prepared from iron turnings and filings and graphite.

The boy finally asked me what all this was for, when I warned him to note carefully all he saw, and after lunch I would explain it to him. We then visited the central pneumatic station of our district, the air-ship yard and repair shops, and many other points of more or less interest. The day had grown quite warm, and to a man of my years a comfortable chair in a cool room was really the proper thing, so that on my suggestion we started towards home.

After lunch, with my pipe between my lips and seated in an easy chair in the library, I was reminded of my promise to explain the things we had seen in the forenoon. Being in a communicative mood, I told him, as near as I can recall now, the following:

"I was born in a town in North Missouri, on the Mississippi river, the eastern terminus of the then second steam railroad in the State. The only other transportation line into the town was the river, which was constantly traversed by stately crafts built expressly for such navigation. The town, or city it was called, boasted of its gas works as far back as I can remember. I can also recollect when coal oil lamps were a rare thing and considered a luxury. Of course you have heard of the kerosene lamp, although you have never seen one. Yes, the kerosene oil is still made in this country, but it is all exported to parts of Africa, South America, India and other parts of the world that are about 100 years behind the times of the present civilization.

"When I was 13 there were many railroads running into the town, and I began to learn at school of the electric light, which, at that time, was regarded as only a laboratory curiosity, and a few years later saw one at the University, being operated by a Grove battery of 50 cells. In a very short time thereafter the papers began to talk of Edison's invention of the phonograph, and Professor Bell's invention of the telephone, and Professor Blake's discovery of the properties of the carbon button. To you it will seem very strange when I tell you that I have seen hundreds of people pay ten cents for the privilege of listening to a telephone or a phonograph.

"It was about this time that inventors succeeded in producing a current of electricity by the application of power, of sufficient voltage to maintain one or more electric lights. In what seems now only a few days the electric light became an article of commerce, and manufactories of machinery and supplies sprang up all over the country; and the agents for the various companies owning patents could be seen in every progressive town and village in the land.

"Prior to this gas had had no rival in the lighting field. The inventions in the field of improvement of quality and methods now made rapid strides, so that in a very short time cities that had been paying $3 per thousand cubic feet for gas of only 16-candle power, were able to get gas of 20 candle power for $1 per thousand cubic feet. Yes, in those days gas was sold by the cubic foot, and the price was the same regardless of the quality of the article; but some of the larger cities required that the quality of the gas should not be below a certain standard of from 14 to 16 candles of English sperm. You know that now gas is measured exclusively by the thermal unit. How did they get at the amount of the consumption of each consumer? Simple enough. Once a month one or more men went from house to house and read the meters, placing the statements in a book for that purpose, from which the bills were made. Yes, it is true that once in a while an unprincipled scoundrel would be employed to take these statements, and instead of attending to his duty would repair to a beer hall and fill in the statements by estimating the amount of consumption, and spend the remainder of the day in revelry and beer; and the bookkeeper would not know but that they were all correct, until someone, or perhaps a dozen consumers, would come in a towering rage, swearing he or they had been out of town 25 days out of the 30, and his bill was as much as last month; and the bookkeeper would probably swear as vehemently that the bill was correct, and to satisfy the irate customer the meter would be read over, only to find out that it had been incorrectly read, or perhaps not read at all.

"It was on account of things of this sort that the gas companies of that day were commonly looked upon as highwaymen or something equally complimentary. As a matter of fact, as a class there were no more conscientious men in the country than the ones conducting the gas business, notwithstanding some of them were given to good naturedly telling fairy tales of yield and saving of coke, percentage of loss, and many other little pleasantries.

"Now, all of this trouble of statements is avoided by the electro. pyrometers, which stand at the central station and show at a moment's inspection the consumption in thermal units of any customer in the district.

"For a number of years there was great rivalry between the gas light companies and the electric light companies, but, owing to the crudeness of the manufacture and method of vending the electric light as compared with gas there were a great many electric light companies that made assignments. But all that is different now.

"You have doubtless read of the balloon in your study of physics. Until 50 years ago this was the only form of vessel used in aerial navigation. and in fact such modes of travel were considered so very dangerous that life insurance companies prohibited aeronautic expeditions in their policies. In the fall of 1878 I witnessed a balloon ascension in St. Louis, at 6 o'clock in the afternoon, and about 10 o'clock that evening the balloon was seen by a farmer on the banks of Lake Michigan. A week later the body of one of the gentlemen who were in the car was picked up on the shores of the lake. The only other occupant was never heard of afterward. You will find this mentioned in the history of the air-ship on the table near you. The balloon was known as Prof. Wise's 'Pathfinder.' I relate this to give you some idea of the immense progress in this direction since that time. I believe I can show you the photograph of an ascension that I took in 1890. Here it is, a little faded but still clear. That balloon was filled with gasoline vapor, and was intended to remain up but for a few minutes. Now these grand ships that we see soaring past everyday are but the outcome of those crude affairs. The invention of an economical method of reducing aluminum, and of producing hydrogen gas in large quantities, made the success of the air-ship of to-day possible. Think of it! Fifty years ago to make the trip from Fort Worth to New York in three days was looked upon as wonderfully quick time; now our swiftest ships, with favorable winds, make the trip in 6 to 8 hours.

"In the Northern States, where the weather grows very cold in winter, ice forms on lake and river from 10 to 20 inches thick, and was formerly harvested, just as grain is harvested in the summer time, and placed in houses specially built for the purpose. From thence it was used in the summer months for various purposes. Some ice was used in the South, and was shipped there from the northern latitudes; but of course there was great loss from melting, and consequent expense, to say nothing of the cost of transportation.

"In this field the inventor was at work in the 19th century, and towards its close ice was manufactured at less cost than that of harvesting the ice, while the investment in the plant for manufacturing, perhaps was less than that invested in the warehouses for storing the natural ice harvested. The manufacture and delivery of ice were also attended with great loss and expense, which does not exist in the present system of cooling perishable stuff, as well as our apartments, by means of pipes operated from central stations.

"The electricity of commerce when first introduced was made by the use of steam engines, which was attended with great waste of energy, not only because of the lack of economy in the use of fuel, but also because there existed a large amount of energy that nature supplied with unfailing constancy which was put to no use whatever.

"Now there is scarcely a natural resource that is not being utilized, the most notable being the Niagara Falls, which supplies an immense territory with power for all purposes by means of this subtle force, electricity. The engineer has subjected Nature by his skill to the same advantage, as, for instance, the Austin dam, which supplies power for such a large territory in our own State; and, singular as it may seem, when it was first proposed to build this dam, there was much opposition to appropriating money to such an enterprise.

"Towards the close of the 19th Century the aggregation of overhead wires, such as telephone, telegraph, and electric light and power wires, was so great that they became a constant menace to life and property. New York city was the first to put them under ground, and to day in every town and city you will see them under ground in similar conduits to the one visited to-day, where are also placed the pneumatic tubes, gas and water pipes and cold air pipes. How inconceivably more convenient, safe and desirable in every way this is than the former method you can scarcely imagine; but to me who saw this wonderful change the past seems but little more than a dream. Prior to being placed in the conduits, the gas and water pipes had been buried in the streets, necessitating tearing them up every time a repair or connection became necessary, thus impeding travel and damaging the pavement. The present system relieves not only the gas and water works of a nuisance, but the public also, while the construction of the conduits made possible our system of cooling pipes and the use of pneumatic tubes intercommunicating through central stations.

"Those large, hot retorts, into which we saw them putting the coal, is the beginning of the process of making our illuminating gas. From the moment the mouth of the retort is closed, absolutely not one particle of the coal that went into the retort is lost. The process, while it is essentially the same as that used nearly 100 years ago, has been so perfected that when the gas is ready to store, it is so thoroughly fixed that the change of temperature it is subjected to does not condense it in the least; to accomplish this cost no end of study and expense.

"The residuals from the gas are all used either in the arts, sciences or household. For instance, you can go to the grocery store and bring a barrel of sugar home in your pocket, but when I was your age a barrel of sugar weighed something over 200 pounds. Yes; this substance we call sugar and use almost exclusively now is saccharine, a retort gas residual. It is not at all strange that we find in coal the various properties of many of the plants of to-day, for the vegetable growth which went to the formation of our coal deposits was unquestionably the most luxuriant that the world has ever produced. In fact certain medicines have been obtained from coal tar which have not been reproduced from the vegetable kingdom of the present geological period. The time was that the sale of retort gas residuals was only a side issue in the business, and yielded only a very small income, hence the name; while to-day so thoroughly is the residual attended to that it furnishes from two to four times the larger part of the income of the factory. The crude oil that you saw is also used in making illuminating gas. Our fuel gas is made from the coke residual and steam, and our air-ship gas is made by passing over finely divided iron mixed with graphite when heated to a bright red, the latter serving as a holder for the iron, thus making it possible to completely oxidize all the iron, which being accomplished, the iron oxide and graphite are reduced to a powder to the superior paint known on the market as graphitic-iron paint, which you will properly conclude is comparatively light in weight, very durable and almost fireproof. From the lime rock is made carbonic acid gas used in refrigerating, and in the manufacture of effervescing drinks of various kinds so generally used everywhere.

"The quick-lime residual finds a ready market. Ammonia gas was used exclusively at one time for refrigerating, but carbon di-oxide is such an inferior conductor of heat that it is better adapted to traversing distances with slight loss, and in addition is susceptible of a much larger range of temperatures. The introduction of a small quantity of ether renders it capable of reducing the temperature below 100° C.

"In the station we visited this morning gas was manufactured for illuminating, power and heating, floating air ships, and for cooling and refrigerating purposes; and in addition to that, hundreds of other industries draw their supplies from that or similar factories the year through. In fact, it is hardly possible to conceive of a single institution which supplies more of the comforts and necessaries of life than do the gas factories of the country.

"Public sentiment has very materially changed concerning these institutions in my lifetime; being looked upon formerly by the masses as a sort of legal extortionists, whom none but the rich could afford to deal with, while now the blessings they bestow on mankind are not only enjoyed but appreciated. Of course it cost a great deal of money to make all these improvements, but, now that the work is done, the cost of living is less, taxes are reduced, insurance rates are reduced, the cost of transacting business is reduced, better health is engendered, we live better, work less and enjoy life more, and for all this we are largely indebted to the advances in the gas business in the past hundred years. When we are warm we open the cold air register, when we are cold we turn on the gas heater ignited by an electric spark; if it is dark we press this button and have gas light, that one and we have electric light. We finish breakfast and decide to take tea at Delmonico's, we take the air-ship. If we want a package of toothpicks we telephone, and in a few minutes the pneumatic tube leaves them on the table. But you never knew anything else, so you cannot appreciate it, although you may understand it.

"All of this reminds me of an experience I had some 50 years ago. I prepared a paper for the Southwestern Gas Association on the subject of the future possibilities of the gas business. Had I known as much of the then future as I do now of the past, my paper would have been as much of a success as it was a failure.

"What! Is it so late? Dinner ready? Well, bless me; I have been talking at an awful rate, and I am half starved, since you mention it."

My recollection of further events of that period was cut short by my return to consciousness and a speedy recovery.

Note.—After writing the foregoing I submitted it for friendly criticism to a literary friend of mine, who, among other things, said that the principal objection to it was that it savored too much of Bellamy's "Looking Backward." I read the book at once, and saw the justice of the criticism, but as I am innocent of literary ability, I am equally innocent of literary theft. Besides, it was too late then to think of writing anything else.

Discussion.

The President—You have heard Mr. Miller's paper. It is open for discussion.

Mr. Enfield—Mr. President, I am now awake to the fact that we have a Jules Verne among us, and that this paper reminds me very much of Dr. Ox and his experiments.

Mr. Miller—Have I made the possibilities too many for you?

Mr. Enfield (pointing to an incandescent lamp)—If there is anything on earth I despise, it is that little imbecile up there; a thing that attempts to be the rival of gas lighting and cannot reach up to its attempt. One thing that struck me in Mr. Miller's paper as wide of the mark and foreign to the title is that he said too much about electricity. The commercial possibilities of gas as portrayed by Mr. Miller are good. I look forward to a time when not a pound of solid fuel will be used under any boiler, in any grate or in any cooking stove—in fact, for none of the minor uses; but that all solid fuel will be first manufactured into gas and distributed through gas mains to supply all the needs of fuel purposes as well as those of light. It may be that gas will have to be made on the ground in some cases where the needs for it are extensive, and large manufacturing works needing large amounts of fuel will, perhaps, have their own gas generator. I look forward to a time when the coal wagon and the wood wagon will cease to roll from door to door, and the solid fuel shall be dumped into large works having large capacity for distribution that shall supply all the small factories and all our homes with the heat and comfort necessary to life; to a time when its use shall make life easier to live, and our homes cleaner and brighter for the conveniences of gas for both lighting and fuel purposes. I am in favor of supporting any business in connection with the gas business when it pays to do so. I believe the arc light is of commercial value, and that the incandescent lights have their purposes, too; but as competitors of gas light, in a financial sense, I do not believe in them. I believe that, while at present people are interested in electrical enterprises, the tide will soon turn, and that gas enterprises will be in more favor. The field is not half explored, and although to-day we are far in advance of what we were 10 years ago, yet gas men have not exerted one tithe of the energy that has been exhibited by the electric men of this age. I believe more in the cheapening of illuminating gas so as to make its uses possible for fuel, and so it can be sold by one company and through one set of mains. We know that in our industry the more gas we make, the more we distribute to the mile of main, the cheaper it can be put to the consumer. Here is the secret of our success or non success, but we find that capital is timid and afraid to take hold of this question in a practical manner. Mr. Miller in his paper, and many other gentlemen identified with the gas business, are contending for electricity as against our own peculiar industry.

Mr. Darney—While it is acknowledged that gas can be produced cheaper than electric lighting, we find that consumers have two objections to its use, one of which is that it vitiates the air and renders rooms unhealthy; another is that the gas does not give a steady light, and this hurts the eyes. These we can overcome quite easily. An argand burner will overcome the unsteadiness; it does not try the eyes.

Mr. Enfield—Consumers object not so much to gas as to the fact that electric light agents point out all the objections possible to be raised against gas lighting, whether reasonable or unreasonable. It is their business to down a competitor and introduce their own wares. Everything that is new, especially when it first comes out, is readily taken up by the people, often without investigation. What rests with us to-day as gas engineers is to introduce new and improved methods of placing our product before our customers. One thing that seriously retards gas consumption is the high price charged for it. There is no question in the world that if gas were sold cheaper, there would be a decided increase in the consumption and general use of the same. It requires courage to reduce prices of gas, but the inevitable reward is an increase of consumption, a decrease of leakage account, and a revenue probably as great as before.

Mr. Russell—Mr. Enfield states that he despises the incandescent electric light; many others did so at one time. Mr. Miller laid stress on the business of electric lighting. Some of us have both, and have of course to protect both interests—let the consumer choose what he wants, pay his money and take his choice. We know that electric light men themselves found they could not produce light as cheap as they thought for. The electric light has come to stay. Let us give the people something new; let us give them gas. Have we been giving them good

gas? We would be ashamed to call the stuff we have been giving them gas. Let us pay more attention to the burners, pipes, etc. The electric man watches his consumers. We walk down the streets, look in the stores, see very poor lights, and at once begin to make the excuse that it is not our fault these people do not have good light; the buildings are not fitted up properly, and the burners are not cared for. When an electric light man comes in he offers to put in for the consumer a lamp, an arc light costing $65. What do we do for our consumers? Let us take as much interest in these matters as they do.

Mr. Enfield—I agree with Mr. Russell in all save his intimation that I do not want to give better gas. I repudiate that.

Mr. Russell—It was a joke.

Mr. Enfield—Good; I accept.

Mr. Russell—Mr. Enfield's assertions are very correct as to the old system. We used to say that 16-candle power lamps could be sold at one cent per hour. We know more about the matter now and what the cost is for labor, etc. We put a meter in to measure the electrical current, and we know that that light cannot be made to sell at the cost of a gas light, but we are bound to protect both interests. Put your gas on a basis of 16 candle power and $2 per thousand cubic feet used through 5 foot tips, and the cost is one cent per hour; then, by meter measurement, you can figure the price that will be equal for 16-candle power incandescent lamps.

Mr. Enfield—Gas companies in most cases should own electric light plants and run them in conjunction with their gas business. The point I wish to make is this: If the people will have incandescent electric lighting they should pay for it on the same basis that will pay to the gas company the same profit that the gas pays. If they do not and if they will not, why not foster the gas business? I believe in electric arc lighting for streets, large stores, and on open places, but when it comes to the incandescent lamp in residences and stores, I believe that people should pay for it just what it is worth, and then let them show their preference.

Mr. Russell—We make the same interest on each of our investments, and that is how we scale our prices.

Mr. Miller—Same thing is now being done in Fort Worth.

Mr. Enfield—It is not done in Dallas.

Mr. Cullinane—In figuring out your interest on your investment do you figure anything for repairs? If you can get the same amount on your electric lighting that you do on your gas lighting how do you arrive at it?

Mr. Russell—I take the aggregate of the outlay in which is charged up every item of expense, oil, water, waste, fuel, etc. We are very careful about the service given, and spare no money in caring for our armatures and in getting good men to attend to them.

Mr. Enfield—Galveston, Fort Worth and San Antonio seem to have got things down in their electrical departments so that they have not much to regret. In each of these cases the companies have full control of the electric lighting business so far as their own plants are concerned. I would like to ask Mr. Russell how much he figures his depreciation to be? From my experience I would figure it to be at least ten per cent. per annum on the cost of the plant.

Mr. Russell—One-quarter of one per cent.

Mr. Miller—I would put it at 25 per cent.

Mr. Cullinane—So would I.

Mr. Russell—The gentlemen forget that I said I charged up repairs separately.

Mr. Enfield—What is the lifetime of dynamos, boilers, engines, armatures, fields, shafting and belting, commutators, pole lines, insulation; in fine, of the whole layout? Does Mr. Russell figure that they will last forever even if kept repaired as nearly as repairs can be made? On renewals to a gas plant we can figure very closely; everything is charged up to repair that is not betterment or construction, and we know what it amounts to at the end of the year almost to a dot, as also do we know the value and condition; but with electrical machinery it is very different.

Mr. Russell—Depreciation is a very vague term; in figuring on depreciation you want to figure it closely. It is impossible to figure the same way each year. If a field breaks I offset the value of the old one by the value of the new one and then charge the balance to repairs.

Mr. Miller—Is it not a fact that the ratio of repairs to ultimate depreciation is 100 per cent.?

Mr. Enfield—In running our small electric light station, of which I had charge about two years, and which at the beginning was practically new, my experience at the end of said two years, and when we turned the thing over to the new company, was that it would have taken at least $5,000 to have put the station in a good working condition; and, yet we had been keeping up repairs, as Mr. Russell states, doing all that was absolutely necessary to keep the thing running, still I estimated it would have taken $5,000 to put the plant in a condition to run another year, without taking into account the permanent depreciation of the plant. The cost of the plant originally was $50,000.

Mr. Russell—I would ask Mr. Enfield if his armatures were not still there; if the cast iron was not as good as at the beginning; if he did not still have his pole lines, dynamos, etc.? If his boilers and dynamos were not crowded how could it be possible for the plant to depreciate to any such sum?

Mr. Miller—(referring to his paper)—I am sorry that my paper was not in a more practical line, but from the very nature of the title I necessarily had to fall back on my imagination.

Mr. Russell—Our thanks are doubly due Mr. Miller for his paper; it takes more intelligence to write from the imagination.

Mr. Enfield—At any rate the discussions have taken a practical turn, and I think Mr. Miller believes as I do about the value of discussions.

Upon motion of Mr. Russell a vote of thanks was passed to Mr. Miller.

THE QUESTION BOX.

The President—There being no other papers to be read we will proceed to the discussion of the questions placed in the "Question Box." The first is—

"*Would it not be advantageous in assigning papers if the subjects selected for members to write upon were given them a year in advance, so that they will have ample time, by experiment and otherwise, to prepare themselves?*"

Mr. Cullinane—I do not think it is necessary to give subjects out so long in advance. The experience of the last programme committee is against that. We did not give the subjects out until some time in January, and the papers have been good and there have been no complaints of any kind.

Mr. Maxon—This question interests me more from the fact that it came very nearly keeping me from coming to San Antonio. My work inside and out has kept me so busy that I had not the time to give to my subject and could not prepare my paper. Had I the subject earlier I could very often have found time and spare moments to devote to it. I am in favor of assigning the papers earlier.

Mr. Russell—The subject I got hold of was not at all to my taste. When a man appears before the public he likes to have on good clothes. If every member were to proffer a paper, something upon which he is interested and qualified to treat, he would be able to put up a pretty good essay. I do not believe in assigning papers; let us choose our own papers.

Mr. Maxon—When I first received notice of the paper assigned me the first question I asked myself was why did they ever ask me to write on such a subject? But it put me thinking and I am very sure it did me a great deal of good.

Mr. Enfield—Messrs. Russell and Maxon are both right; we are all right. The matter of assigning papers is not only very distasteful to those to whom they are assigned, but distasteful to the committee assigning them. We concluded to make up a list of papers and ask the brethren to write on the subjects assigned them. I think most of you have thought our list of papers a good one. Cullinane assigned me my paper, and I did not like it at all; I wanted to write on fuel gas. I do not know that the committee on programme could do better than to ask each member the subject he would like, then again, if I were to meet a man and ask him to do something, if convenient, it might not be convenient; but if I told him to do it he would be pretty apt to have the work done.

Mr. Cullinane—Messrs. Russell, Maxon and Enfield are all right. It does not necessarily follow that because a man has a subject he must write on it. Let him change it if he wants to. The paper I read was not the one assigned me, but I liked the subject better than the other, so I substituted it.

Mr. Russell—If I were advertising to sell lard, I believe I would not sell butter. We advertise this thing, send programmes to the JOURNAL, and issue invitations. Some one might say, "I believe I will go down and hear what that fellow has to say on that subject." He comes two or four hundred miles only to find the subjects have been changed, and he has to eat butter instead of lard.

Mr. Enfield—We asked for butter and we got it; we asked for lard and we got it; we asked for vinegar and we got sugar; we asked for bread and we got it; brother Cullinane asked for coals and he got—something.

Mr. Russell—We did not ask for natural gas, but we got it.

Mr. Judge—In preparing a paper it is sometimes necessary to make experiments. It seems to me if the members had more time it would

be best. Many will not write at all unless a little pressure is put under them. If they do not like their subject I think it is a good idea for them to change; it would be an advantage.

Mr. Russell—I think we ought to name a variety of subjects, pass the list around and select what we want.

Mr. Miller—Some would take all.

Mr. Russell—Good; let him do it. It would be all the better.

Dr. McFadden—"Blessed are the peace makers." As you have honored me with a badge that gives me the privilege of sitting down among you, I would like to make a suggestion to Mr. Russell. I suggest that the subjects be given by the members to the committee three months before the meeting of the Association, and if the members fail to do so in that time the committee shall then assign them subjects.

Mr. Russell—Even with the little time I had if I came here without a paper I should have felt very badly. So far as poking up these fellows is concerned, we are now in an advancing age, hence if we settle down and say, "Here, I will write on this," you have my word then and I will write the paper.

Mr. Enfield—I move that the committee on programme ask each member to select a paper and notify the committee three months before the meeting, and if in case this is not done that the committee then assign a subject to that member. [Adopted.]

Question No. II.—"*When using lime for purification, if you find it caked hard, how do you account for it?*"

Mr. Russell—That is a tough one. Unless you have all the circumstances and go to the trouble of analyzing the material, I do not see how you are going to get at it.

Mr. West—I have had some experience in that. Some time back my gas went to the purifiers very hot, and during that time I noticed that the lime came out in large cakes and was still as white as when it was put in. I attributed it to the gas being so hot while going through the purifiers.

Mr. Russell—I must differ from Mr. West. I got mine out very much caked at one time—I purified 7,200 feet to the bushel with shell lime. I know my conditions were such that it was not due to the gas being hot. How does Mr. Enfield account for it?

Mr. Enfield—When a man is challenged what is he going to do? One gentleman made the statement that his lime came out as white as when he put it in, besides being caked very hard. Of course many chemical changes take place in the purifiers, and we do not know all that does take place. I remember a discussion on this subject some years ago. The supposition was (I say supposition, because, as Mr. Russell stated, no analysis was made) that this lime remaining so long in the boxes would take up a very large amount of carbonic acid, so as to almost practically reduce the hydrate of lime to the carbonate of lime similar to what it was in the original, and that this amount of duty, and extra time left in the purifier, would also harden the lime, and the chemical change would render it white again as in the original.

Mr. Cullinane—Mr. Geo. F. Goodno read a paper, at the last meeting of the New England Association, on the subject of purification, which paper was discussed very freely. The conclusions arrived at were that the rapidity and quantity of gas passed had a great deal to do with the condition of the lime in the boxes.

Mr. Russell—In running our purifiers we always believe in having one clean box, so that the sulphureted hydrogen may be entirely eliminated from the gas. There is also a great deal in properly tempering the lime before introducing it to the boxes.

Mr. Enfield—I read the paper referred to, and, if I remember right, one of the conclusions was that the size of the boxes should be commensurate with the quantity of gas passed through them. In all chemical action time must be given. If we rush gas through too quickly we cannot expect the reagent to do its duty properly as required of it. I will say this of the Western gas engineer: From the nature of their works and the growing demands, sometimes improper understanding of condi tions is required, and they are not fixed to handle the work expected of them in a proper manner. Under this condition of things it requires more engineering to accomplish proper results.

Question No. III.—"*What will prevent iron from oxidizing where the water mark reaches the cups of the purifiers?*"

Mr. Miller—Coat these covers with crude petroleum or put it on top of the water.

Mr. Russell—It is a good idea to let the petroleum settle down with the water so as to lubricate the sides of the boxes.

Question No. IV.—"*What is a good joint to connect mouthpieces to retorts, and how should it be applied?*"

Mr. Russell—I use nothing but calcined fireclay mortar.

Mr. Maxon—I use a little iron borings mixed with fireclay.

Mr. Enfield—The more care you exercise in putting on your mouthpieces the better, as it is important for the joint to be well made at the start. The method I follow is to put on whatever material I use by first wetting the mouth of the retort, then lay the material on thick, and put up the mouthpiece; run it up close, and tap it all around with a scantling, lightly, and have the men screw up the nuts each time they tap, starting at one and going entirely around the mouthpiece each time. I do not believe it is necessary, as in days gone by, to take 48 hours to put on a set of mouthpieces by means of jackscrews and levers.

Mr. Russell—I do not want you to think we are old fogies in this matter, or that we cannot put on a set of mouthpieces within a reasonable time. In our works we build a rigging so that we can bring a pressure to bear upon the mouthpieces and draw the nuts up slowly so that no air holes, pores or anything of that kind can take place. We do not have any leaks in our mouthpieces at all.

Mr. Maxon—I do not understand how the rigging is held to the front of the bench.

Mr. Russell—Bars that come out at the bottom take a grip on the floor.

Question No. V.—"*What is the average make of tar to the ton of 2,000 lbs. of Nation coal carbonized?*"

Mr. Enfield—That is answered by my paper on coals.

Question No. VI.—"*What is an average make of ammonia water to the ton of 2,000 lbs. of Nation coal carbonized?*"

Mr. Enfield—That largely depends on the kind of coal and the apparatus used up to the point where the liquor is drawn off. I take it that it depends very largely upon conditions, but I have not as yet made any close tests so as to answer this question. There is unquestionably an average. Among our Western gas engineers, K. M. Mitchell, of St. Joseph, Mo., would be found ready to answer this question.

Question No. VII.—"*Is there any market for ammoniacal liquor in Texas?*"

Mr. Enfield—If the gentleman asking that question will communicate with me I will be very glad to take the matter up with him.

The Association then adjourned.

[Prepared for the JOURNAL.]

An Experience in Purification.

By Mr. T. A. BATES, Engineer City Gas Light Co., Norfolk, Va.

For four years it has not been my privilege to attend any meetings of the gas associations to which, in former years, I looked forward with so much pleasure and anticipation, yet the proceedings, as published in the JOURNAL, have been carefully followed, and many items of interest there brought forth faithfully noted. Papers on purification have probably attracted as much attention as any other. Being debarred from giving observations and results in that line at meetings, I may be pardoned for now presenting them through the medium of the JOURNAL.

Taking charge of a very small works, in Southern Kentucky, in January, 1866, soon after leaving Uncle Sam's service, with an *ignorance* about the gas business which would fill a volume, and at a time and in a section where labor was scarce, many duties usually performed by others devolved on the Superintendent. During that year (*by accident*) I first made the discovery that lime, as ordinarily prepared for the purifiers, was inefficient. Having to play purifying hand for some time, I found the process of screening lime, moistened according to practice observed elsewhere, a most disagreeable task, by reason of its floury consistency. Water was added and the lime turned until it was of such nature as to be passed through a sieve without pasting. I have no data as to amount of gas passed per bushel of lime; but by the time I had treated the four boxes with lime of my preparing, it became apparent that, when a box changed every other day had been about the rule, they now ran one week. Verdant as I was, this was too palpable a difference to be unheeded, so the method obtained with us at once.

The year I saw the first meter man—Mr. E. S. Funnell—through him I learned of the JOURNAL and subscribed. To him also I related my experience with lime which he noted, as was his custom. In October, 1870, a larger works offered, and another, in May, 1872. In each of these the lime was used as in my first works, and data showed an increased purification of fully two fold over the dry lime method. So strong was force of habit or prejudice that discharge of the old purifying hand in each place was forced on me 'ere I could have lime prepared as I wished.

While the use of oxide by other companies has been known to me for years, and the manner of revivification seen by visits to widely separated works, yet personal experience with it dates back a little less than 6 years, and in two works. In the first the experiment was brief—less than a year—but very conclusive. A mass of "Connelly Sponge" was found in the cellar under condenser and washer room, that had been *pronounced worthless*. Culling the most that I could from the tar and filth, it was wheeled to a covered shed and spread 6 inches deep. One foot of the shed siding was cut away right over the surface of the sponge. Copperas water (1 pound copperas to 1 gallon water, heated by steam appliance) was sprinkled over it to fair saturation. The mass was turned over two or three times, and then allowed to stand two days. This process was repeated three times, and the stuff was then put into the purifiers. The first round (as with new sponge or oxide) did not show excellent results; but after about three changes, with saturation each time as at first, the mass seemed to be fixed—so much so that (our retorts remaining idle at times 4 to 6 hours), by taking caps off box covers and plugs out of inlet pipes to seal, with boxes 5 ft. × 5 ft. × 2 ft., charged with 8 bushels breeze, 13 bushels sponge, and 8 bushels lime, we purified 1,754,000 cubic feet of gas, and but *one* of the three boxes marking *slightly*. Previous to this, with use of lime, a box was changed for an average of every 20,000 cubic feet of gas made.

The method used here, and results obtained as well, I made known to several of my confrers before leaving Ohio, and some have been benefited thereby. Since taking charge here, a little over four years ago, opportunities for repetition of experiments with oxide, or sponge, copperas water and admission of air with gas, have been better than before. On the installation of a water gas plant, nine or ten years ago, as an adjunct to the coal gas plant, the superintendent in charge considered it impossible to use sponge, and abandoned it, some 800 bushels being piled in the yard. At the earliest opportunity the sponge was culled, spread and wetted, as heretofore mentioned, then gradually substituted for lime, in the boxes. Comparison of results will be made only with ourselves, when using *shell* lime, and now, when using ashes (we use our breeze), sponge and pine turnings saturated as is the sponge. The comparative figures for November and December, 1887, and November and December, 1890, are as follows:

Date.	Am't Gas Made.	Boxes Changed.	Purified per Bush. Material.	Material Used.	Kind of Gas Manufactured.
Nov. and Dec. '87	11,532,500 c. ft.	19	5,806	Lime.	Coal and water combined.
" " '90	13,277,600 "	7	15,094	Ashes, sponge and shavings.	Coal and water combined.

From February 18, 1891, to April 15 1891, we have made 10,398,600 cubic feet, mostly water gas (as we dropped our coal benches at end of February). Boxes have been changed as follows: February 18th and March 19th, with two of the boxes yet clean. This being at rate of 34,662 cubic feet per bushel of material. Size of boxes, 14 ft. x 14 ft. x 3 feet deep.

During this period of use of oxide or sponge, none has ever fired in revivifying, and but once in the boxes (during my absence). On charging box we take off only air vent cover, letting it so remain for 24 to 36 hours. In spreading we keep it 6 to 8 inches deep. Cover being rather limited it is mostly used for the pine turning, oxide being principally exposed to the elements. Whenever labor is convenient and weather has been dry for 48 hours the stuff is cut over. Changing so seldom it has chance to lay a long time idle. After the shavings and oxide have been used and revivified four or five times, I treat it to a solution of copperas, as at first; and, at this writing, I look on the material as in better shape than it was three years ago.

Now a word or two as to our use of air taken in with the gas. During the period when we make a mixed coal and water gas more air is admitted than when making water gas alone. Experience having proved to me that an addition of 1¼ to 1½ per cent. of air doubles the service of purifying material; and at same time, very careful calculation of materials used in gas making, with photometric observations, shows scarcely any diminution of candle power by addition of air—we meter our air. With water gas alone I have not been able to find so marked an aid to purification by admission of air, so useless.

Rebuilding our smaller holder three years ago, I adapted it for use as a relief holder, and it has well repaid us. Instead of the gas passing meter (other apparatus of course in sequence) at as high *rate* as 380 cubic feet per minute, with consequent blow-outs everywhere, we now rarely exceed, with our maximum make, 185 cubic feet per minute. The difference in pressure at inlet to purifiers is marked.

	Min. Press.	Max. Press.
Without relief holder,	8 inches.	14 inches.
With " "	4½ "	6 "

I trust this prosaic statement may be of interest to some.

The Effect of Temperature on the Limits of Explosions of Combustible Gaseous Mixtures.

[Condensed from an article, in the *Journal fur Gasbeleuchtung*, by Mr. J. Roszkowski.]

The author uses the term "limits of explosion" in the following sense: A combustible gas is capable of explosion not only when mixed with the exact quantity of oxygen required for its complete combustion, but also when the supply of oxygen is in excess of this. When the proportion of oxygen in the mixture is gradually increased, the explosion becomes weaker; and at last a point is reached at which the mixture can no longer be exploded. This is called the lower limit of explosion. It is this that corresponds to the smallest percentage of combustible gas. Similarly, if the proportion of oxygen present be gradually diminished, a point will be reached at which the mixture will be incapable, or only just capable, of explosion. The border line separating the two is called the upper limit of explosion. It corresponds to the largest percentage of combustible gas. These limits have already been investigated by Bunsen, Frankland, Meyer, Lehmann and Wullner. Wagner has shown that a mixture which cannot be exploded by a spark from a small induction coil may be exploded by a spark from a stronger coil. No experiments have hitherto been made on the effects of pressure and initial temperature. The author has investigated the latter point, which is of considerable practical importance. In the cylinder of a gas engine, for example, there is a series of explosions occurring in which the combustible mixture is initially at a high temperature. The experiments (upwards of 1,000 in number) were made at temperatures of 15°, 100°, 200° and 300°. The combustible gases investigated were hydrogen, carbon monoxide, marsh gas and coal gas.

I. *Hydrogen.*—The first experiments described were those made with hydrogen mixed with oxygen. At the ordinary temperature (15°), the lower limit is a mixture containing 1 volume of hydrogen to about 9.25 volumes of oxygen; in other words, the mixture will still just explode when it contains 18.5 times as much oxygen as is required for the complete combustion of the hydrogen. The upper limit is 1 volume of hydrogen to 0 1013 of oxygen at 15°, and 1 to 0 0654 at 300°. Thus rise of temperature extends the upper, but scarcely affects the lower limit. The next experiments were with hydrogen and air. Here, again, rise of temperature causes no noticeable change in the lower limit (excess of air); whereas it extends the upper limit from 0.1147 at 15° to 0 0548 at 300°. (The limits are always expressed in terms of the volume of oxygen required per unit volume of the combustible gas, or else in percentage by volume of the combustible gas in the mixture.) The third series of experiments were with hydrogen and a mixture of oxygen and carbon dioxide. This mixture contained 21 parts of oxygen to 79 of carbon dioxide, by volume. It might be regarded as common air in which the nitrogen was replaced by carbon dioxide. The experiments showed that generally the limits of explosions were even more restricted by dilution with carbon dioxide than by dilution with nitrogen. Up to 100°, however, the limits were somewhat extended, especially the upper one. Further rise of temperature restricted the range; so that a mixture which was explosive at 15° or 100° would no longer explode at 200°, and one which would explode at 200° would not explode at 300°.

II. *Carbon Monoxide.*—The first experiments were made with carbon monoxide and oxygen. At 15° the maximum amount of oxygen that could be added was 5.41 volumes to 1 volume of carbon monoxide—*i. e.*, 10.8 times the theoretical amount. The minimum amount of oxygen necessary was 0.066 volume. These correspond to mixtures containing 15.6 and 93.8 per cent. of carbon monoxide respectively. The range increases from 0° to 100°, and from 100° to 200°; but from 200° to 300° it diminishes—the limiting values at the latter temperature being 3.140 and 0.086 volume of oxygen, or 21.4 and 92.5 per cent. of carbon monoxide. The remaining experiments were with carbon monoxide and air, and carbon monoxide mixed with oxygen and carbon dioxide. The results in both cases were similar to those obtained when oxygen alone was used. The author repeatedly found that mixtures which could be exploded at the ordinary temperature would not explode if they had previously been heated to 300°. He attributes the restriction of the limits, especially the upper limit, at high temperatures to a gradual union of the combustible body with the oxygen at these temperatures. This is supported by the appearance of a bright blue aureole around the sparking wires, and also by actual analysis of mixtures before and after the gain.

III. *Marsh Gas (Methane).*—The first experiments were with marsh gas and oxygen. At 15°, marsh gas requires at least 0.7517 of its volume to form an explosive mixture with oxygen. It can support an admixture of 14.7 volumes of oxygen, or about 7.3 times the amount required

for its complete combustion according to the equation $CH_4 + 2O_2 = CO_2 + 2H_2O$. Rise of temperature scarcely affects the limits. This is true also for the next mixtures tried—viz., marsh gas and air, and marsh gas with carbon dioxide and oxygen. The first mixture must contain about twice as much oxygen (1.323 volumes) as when pure oxygen is used. It still explodes when it contains 3.29 volumes of oxygen or 15.65 volumes of air to 1 of marsh gas. Admixture of marsh gas with carbon dioxide restricts the limits much more than admixture with nitrogen. They lie very near together; the extremes being mixtures containing 9 and 11.6 per cent. by volume of marsh gas. This nearly corresponds to the theoretical quantity required for combustion.

IV. *Coal Gas.*—The gas used was that ordinarily supplied in Carlsruhe. Its commencement and end of the experiments is given below:

	Before Experiments, Vol. per Cent.	After Experiments. Vol. per Cent.
Hydrogen	50.6	48.6
Marsh gas	34.8	33.6
Carbon monoxide	6.2	6.5
Hydrocarbons (ethylene, benzene, etc.)	5.3	5.3
Carbonic acid	1.9	2.1
Nitrogen (residue)	1.2	2.8

At 15° coal gas requires at least 0.4358 of its volume of oxygen to form an explosive mixture. It can support admixture with 12.25 volumes of oxygen—the amount found by experiment to be necessary for complete combustion being almost exactly 1 volume. These correspond to mixtures containing 69.6 and 7.5 per cent respectively by volume. At 300° the upper limit is increased by 2.3 per cent.; the lower by only 0.3 per cent. With coal gas and air, at 15° the lower limit is 13 volumes of air, or 2.8 volumes of oxygen to 1 of coal gas; the upper limit, 0.71 volume of oxygen. These correspond to mixtures containing 7 and 22.6 per cent. by volume of coal gas. At 300° the upper limit is extended by 6 per cent.; the lower by 0.5 per cent. In the case of coal gas with a mixture of oxygen and carbon dioxide, at 15° the limits are 7.9 and 25.1 per cent. by volume of coal gas. At 300°, they are 9.4 and 18 per cent. respectively; so that rise of temperature narrows the range.

All the above experiments were made with moist gases. Similar results were obtained with dry gases, excepting that carbon monoxide did not in any case explode. The gases used were not always quite free from admixture with air; but in all cases they were as pure as could be expected, considering that they had to be stored in considerable quantity. The transition from explosive to non-explosive mixtures was not by any means abrupt. As the composition of the mixture was altered, the force of the explosion usually became gradually less, until it passed into a slow combustion in the neighborhood of the sparking wires.

The original paper contains copious tables of results, together with theoretical discussions and details of methods of preparation, analysis, and experiment.

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, April 10, 1891.

King's Choked Pipe Preventer—Lowering a Water Main in situ—Differential Prices in Small Towns—Cost of Electric Lighting.

At the recent meeting of the Southwest of England District Association of Gas Managers, one of the items on the programme was a paper, by Mr. E. C. Riley, of Swindon, comprising a description of an arrangement lately carried out by him for the prevention of deposits of pitch in the hydraulic main. He simply raised the hydraulic 20 inches above its former level, and the result justified his expectations. The clear space between the bottom of the hydraulic and the top of the retort setting was formerly 1 ft. 6 in., and now it was 3 ft. 2 in. The causes that led to the success of this operation were discussed at length, after the reading of the paper. It was pointed out that the hydraulic would not have been judged to be too close to the setting in the first place, by many gas engineers, who would consider that the clear space of 18 in. was quite sufficient to prevent undue heating of the contents of the hydraulic by radiation from the top of the stack. The alteration not only involved moving the hydraulic, but also lengthening the ascension pipes. The effect of this would be that a larger proportion of the heavy parts of the tar would be condensed in the ascension pipe and would return to the mouthpiece. The fact that the length of the ascension pipe exercises an important effect on the matter of chokes was fully brought out. Some few years ago my friend, Mr. Lowe, of Weymouth, was troubled with chokes in the ascension pipes, and he noticed that they favored the top retorts, which had the shortest ascending pieces. It occurred to him that, if a bottom retort with 13 ft. of upright pipe worked without choking, whereas a top retort with 10 ft. was frequently giving trouble, the length of upright pipe leading from the latter might be increased with some advantage. The bridge pipes on the top retorts were accordingly taken off, two short pieces of pipe of equal length, about 3 ft. long, put on, and the bridge pipe replaced. Instead of raising his hydraulic, Mr. Lowe raised the bridge pipe. The arrangement proved a practical preventative of chokes, and I believe it is still used at Weymouth.

In the course of the subsequent discussion Mr. Lyon described an appliance lately invented and introduced at Manchester, by Mr. Alderman King, as a prevention of choked pipes, and also of the foul smoke evolved on striking the retort lid, that is caused by the combustion of pitchy matters in the mouthpiece. It is known by the not very euphonious but attractive (to gas managers) title of "a choked pipe and smoke preventer," and consists simply of a sort of collecting box introduced on the ascension pipe, at a point a little below the level of the bottom of the hydraulic. The assumption is that a large portion of the pitch and soot in the ascension and mouthpiece is due to the return of tarry matters condensed in the upper and cooler part of the pipe, to the mouthpiece, where they undergo a second distillation, resulting in the lighter matters passing off up the pipe, whilst a residuum of pitch gradually accumulates. By collecting these condensed matters and conveying them to a common collecting trough through a short piece of pipe, it is claimed that the nuisances above referred to are prevented, and at the same time the yield of tar and liquor is increased. So far the experiment at Manchester appears to be a success. Several hundreds of mouthpieces have been fitted with the device, and it is found efficient as regards prevention of chokes, while the quantity of fluid drawn from the collecting boxes, *i. e.*, matters condensed in the upper part of the pipe, and that would otherwise return to the retort, represents 1¼ gallons of tar, and 4¼ gallons of weak ammoniacal liquor, per ton of coal carbonized. It will be interesting to compare the working results with the addition of this appliance, as compared with those formerly obtained. The tar which returns to the mouthpiece in the ordinary way is not totally wasted. The lighter parts would appear either in the tar or in the gas, so that although a balance to the good would remain, there are deductions to go against the yield of tar from the collecting box.

Alderman King's invention illustrates a fact that I have mentioned more than once—viz., that the upper part of the ascension pipe, say the top 3 feet, is a powerful condenser. The total yield of tar from a ton of coal is 10 to 12 gallons, and of ammonia water 15 to 20 gallons. So it appears that, to speak roughly, about 20 per cent. of the tar and liquor is condensed in the upper part of the ascension pipe. But it is possible that the larger surface afforded by the collecting box causes condensation to obtain to a greater degree than it formerly did with the ordinary ascension pipe. Although the new appliance will probably show an increased return for tar and liquor, it is not likely to amount to anything like the quantity collected by it.

At a meeting of engineers lately held in the north of England, an interesting account was given of the lowering of a water main, 30 inches in diameter, a distance of 3 feet 8 inches, at a point where a railway crossed the road, and this without breaking joint or cessation of the supply of water. The conformation of the neighborhood was favorable, as the pipe had a fall each way, from the point where it was to be lowered. A wide trench was opened, stripping the pipe for a length of 150 yards in each direction. Gaps of 6 feet wide were then cut out under the main to the desired depth, it being arranged that a joint should come in the middle of each gap, which left a solid pillar of earth, 3 feet thick, supporting the center part of each pipe. These pillars were gradually and regularly scraped away, so as to allow the main to settle down by its own weight. At the same time, the joints were watched by a large staff of experienced pipe layers, who immediately set up any joint that showed sign of leakage or weeping. The operation was necessarily slow, as each of the 100 supports had to be attended to and watched. But it was accomplished without the slightest interference with the water supply, and without the loss of more than a few gallons of water. Every precaution was taken against accident, a man being stationed at the nearest controlling valve, and a chain of signalmen arranged, so that in case of a serious fracture the water supply could be stopped at once. The pipe supplied a population of some 300,000 persons, to whom a cessation of the water supply, if only for a day, would have been a great inconvenience.

A Danish gas manager, Mr. Ernst, has hit upon an ingenious plan for differentiating the gas used for cooking purposes, from the general consumption, without the trouble of separate service pipes or meters, which has hitherto been found to be necessary if a special cheap rate is

charged for gas used for cooking. It appears that in his district the good old rule of "early to bed and early to rise" is followed, as during the long days he finds that the consumption of gas in a private house may practically be taken as representing the consumption in the cooking stove.

The quantity of gas used during the month of June is ascertained and is taken to represent one month's consumption of gas at the cheap rate. A similar quantity is, therefore, deducted from each month's consumption throughout the year, and the remainder charged at the full price. Mr. Ernst's plan is no doubt applicable in small towns, where the number of cooking stoves in use is not large, and where the expense of separate service pipes and meters would count as a heavy item. It is a good plan for such circumstances that I have met with and is second only to the simpler and fairer device of one all-round, moderate price. Anything in the way of special rates carries certain objections with it. If the cooking stoves are supplied at a cheaper rate, the users of gas engines and warming stoves expect to participate. And then there is sure to be some one or other who has a dark cellar and uses gas lights all day, who does not see why he should be charged full price, while his neighbors are cheerfully running gas engines and cooking stoves with the benefit of a large discount. One objection to the plan of deducting a fixed quantity from each month's consumption is the difficulty that would arise if, from any cause, the consumption was less than usual and perhaps fell below the allowed quantity. In such case the quantity to be charged at full rate would be a *minus* and perhaps the customer would expect it to go to the credit of the next account. It would pay any large consumer of gas for lighting purposes during the winter to put in a cooking stove in the summer, and drive it pretty hard during June, so as to secure a large rebate on his accounts throughout the year. Cases of this sort, however, can be guarded against by ordinary watchfulness.

According to an estimate that appears in an electrical journal, the cost of electric lighting, at the price of 8d. per unit, which is at present charged in London and on which no dividend has yet been earned, is more than three times that of gas. This agrees fairly well with the rule that each penny per unit is equivalent to one shilling per 1,000 cubic feet for gas. Eight pence per unit is equal to 8 shillings per 1,000, and the price of gas in London is at present about 2 shillings, 9 pence, or 2 shillings, 6 pence. At such prices electricity can only remain a light of luxury, within the reach of only those who have more money than they know what to do with. Nor does there appear to be very much margin for improvement, so far as the present system of boiler, engine, dynamo and possibly storage battery in addition is concerned. The introduction of electric lighting to anything like such an extent as to make it a genuine rival to gas lighting, must depend upon the invention of a direct means of generating electricity, instead of the present roundabout way of lighting a fire to generate steam, using the steam to drive a motor, and applying the mechanical force thus rendered available to the generation of electricity. Cannot Mr. Edison get at a direct jump from heat to electricity, so as to cut out the intervening boiler and machinery? From what I hear, I believe the electricians would be glad to get rid of their dynamos, which are apt to cut up rough at times.

Separately Measuring Gas for Cooking and Lighting Purposes through One Meter and Service.

[Communicated to the London *Journal*, by E. U. G. Ernst, Engineer and Manager of the Aarhus (Denmark) Gas Works.]

It is a gratifying fact that gas finds more and more favor with the public as a substitute for fuel, on account of its excellent qualities, cleanliness, accommodation and economy; and as this is a matter of great importance for gas works, I think every conscientious gas manager ought to study how to promote its use, so that it may become a necessity in every household. Making a reduction in the price will always be the most practical means of attaining this end. When, therefore, two years ago, the question of employing gas for cooking purposes was having considerable attention in our town, we resolved to try to increase consumption in this manner.

In order to ascertain to what extent gas was used for culinary purposes, an enumeration was undertaken, which showed that there were 400 families who burnt gas for both lighting and cooking. A reduction in the price of gas consumed for cooking would require these 400 families to have two meters, and their services taken down and altered, and in many cases new services laid into the houses, so as to avoid the so-called "bi-meters," which give rise to complaint from the public, and cause a great deal of trouble in making out accounts. These arrangements would involve cost and dissatisfaction, both to the consumers and the suppliers of gas. It occurred to me that there was a way of avoiding these inconveniences; and I eventually succeeded in finding out a method by which the consumers could keep their services unaltered, and still derive benefit from the reduction in price, without incurring expense for new meters.

My plan is founded on the following facts experienced in everyday working: (1) That the consumption of gas for lighting purposes in the month of June may be regarded as almost *nil;* and (2) that the consumption of gas for cooking is, on an average, almost the same all the year round. We may therefore assume that a customer's gas consumption in June is equal to his monthly demand for gas for culinary purposes, and that consequently (1) his yearly consumption of cooking gas is equal to twelve times his consumption in June, and (2) his consumption of lighting gas equal to the consumption beyond that.

The following table, in which I have taken the consumption over a year, shows the plan more clearly:

	Quantity of Gas Consumed Cubic Feet.	At the Cooking Price. Cubic Feet.	At the Lighting Price. Cubic Feet.
June, 1890	1,000	1,000	—
July "	1,100	1,000	100
Aug. "	1,300	1,000	300
Sept. "	1,500	1,000	500
Oct. "	1,800	1,000	800
Nov. "	2,300	1,000	1,300
Dec. "	3,000	1,000	2,000
Jan., 1891	2,800	1,000	1,800
Feb. "	2,200	1,000	1,200
March "	1,700	1,000	700
April "	1,400	1,000	400
May "	1,200	1,000	200
Total	21,300	12,000	9,300

The consumer will consequently have to pay for his total gas consumption in the following proportions: 12,000 cubic feet at the price of cooking gas, and 9,300 feet at the price of lighting gas. It is evident, however, that a consumer might endeavor to take advantage by burning a great deal of gas in June, as he would then get part of his winter consumption of lighting gas at the price of cooking gas. This may easily be prevented by making the following stipulation: "If the consumption in June exceeds that of May or July in the same year to the extent of 25 per cent. or upwards, the normal monthly consumption of cooking gas is to be reckoned as equal to the smallest consumption in these months." It would also be advisable to make it a condition, as against consumers whose consumption of lighting gas in June amounts to a considerable part of the total quantity burnt in this month, that the gas company are to be entitled in such cases to have separate meters fixed for registering the supply of cooking gas.

After full discussion in the Town Council, the system I have described was adopted in Aarhus as from June 1, 1889; and since that time it has answered perfectly all the expectations entertained in regard to it. First of all it has the advantage of saving the gas undertaking the expense of purchasing and maintaining a great many meters; and, secondly, the consumers are spared the cost of altering their services, while they still profit by the reduction in the price of cooking gas. As to the calculation of the amounts of the accounts, which it was apprehended would present some difficulties, I am pleased to state that nothing of the kind has occurred, and not the slightest inconvenience has been caused.

It would give me great pleasure to see this method introduced in other countries; and to this end I shall be willing to answer any letter on the subject, or to give any further explanations that may be required by my highly-esteemed colleagues in England or elsewhere.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

Mr. H. Ranshaw, President of the Stacey Manufacturing Company, writes us that they have received contracts for the construction of a new holder (capacity 600,000 cubic feet) for the Peoples' Company, at Cleveland, Ohio. Also, a 200,000 foot holder for the Covington (Ky.) Gas Light Company. The latter will add new purifiers, to be furnished by the Stacey Company.

The Bridgeton (N. J.) Company have purchased a plot of ground, lying immediately south of the present buildings, whereon to locate an additional holder. It will be put up this summer.

The Hon. H. J. Jones, who was recently elected Treasurer of the Peoples' Gas Light and Coke Company, Chicago, Ills., has been Superintendent of the Special Assessment Bureau of Chicago since 1869. He assumes the duties of his new post on Friday next. On tendering his

resignation to Public Works Commissioner Purdy, that official forwarded the following letter in acknowledgment of its receipt: "Chicago, April 10, 1891. H. J. Jones, Esq., Supt. Special Assessments. Dear Sir: Your letter of the 9th inst., tendering your resignation as Superintendent of Special Assessments, is received. In considering the same I am reminded that you have given to the city over 22 years of more than ordinary, faithful, efficient and untiring service, occupying a position intricate and responsible, and possessing during that whole period the confidence and esteem of the public and a high appreciation of your ability and integrity by the various administrations under which you have served. In accepting your resignation permit me to express my regret that this business association must be severed so soon, and I am assured that the officers and employees of the city government with whom you have been so long connected will join me in wishing you the success and happiness you so richly merit at your new business home. Yours, very truly, W. H. Purdy, Commissioner of Public Works."

THE Westinghouse Machine Company has mapped out a very effective plan this year for attracting attention to the goods which it makes a specialty of. Having arranged with the leading journals devoted to the advancement of industrial pursuits for space in their advertising columns, the Company proposes to publish 12 different advertisements in the course of the year, and these 12 chapters will constitute a readable, even if brief record of its operations. For instance, the April chapter (which has duly appeared in our columns in appeal to the gas fraternity) was devoted to explaining, 1st, that four types of engines are put out from the works; 2d, that as the goods are made to hardened steel templates, they are consequently interchangeable; 3d, that both engines and "repairs" are carried in stock; 4th, that all goods are sold through the medium of resident agents (the names and addresses of these are given) in almost every part of the civilized world. The card for May is to be devoted to a resume of the points that seem to have gained favor for the Company's specialty; and the June chapter will outline the differences between the Westinghouse and other types of engines. The later chapters we are told will contain illustrated descriptions of the four styles of engines made by the Company, the date of their invention, and the number of each sold up to the time of the recapitulation. Following numbers will be devoted quite likely to illustrated descriptions of some of the more prominent installations of Westinghouse steam plants in this and other countries. The scheme is a novel one, is sure to prove effective, and reflects credit upon the ingenuity of the "literary staff" of the Company.

THE gas and electric lighting interests of Medina, N. Y., have been consolidated, Mr. C. T. Lindley, of the Gas Company, retaining a controlling interest in both plants. The real cause of the consolidation was the granting, by the authorities, of a contract for the public lighting of the town by means of electricity.

A CORRESPONDENT (writing under date of April 15th), at Marquette, Mich., says: "Mr. J. E. La Londe, Manager of the Ishpeming (Mich.) Gas and Electric Light Company, is preparing an estimate of the cost of putting in and operating an electric light plant in connection with the gas supply. From the expense to be incurred he will determine at what price he can supply the light to consumers, and if a certain number of lamps will be taken in advance the installation will be made. It is also likely that the plant will be located midway of Ishpeming and the adjoining town of Negaunee.

THE improvements on the works of the Downington (Pa.) Gas Company are well under way. Messrs. Janeway and Logan, the proprietors, are well pleased at the reception that has so far been accorded them by the residents. It may be taken for granted that enterprise will receive substantial reward.

S. F. LE SIEUR will build a gas works at Provo City, Utah. He asserts that the franchise recently passed to him was not obtained for speculative purposes, and that construction work will be hurried to completion after the start has been made. This place, which is the original capital seat of Utah, is located on the Provo River, at a point nearly three miles east of Utah Lake, and lies near the west base of the great Wahsatch Mountain range. It is on the line of the Utah Southern Railroad, is 48 miles south-southeast of Salt Lake City, and is the center of a very fertile plain which is peculiarly well adapted to the growth of grain, etc. The population of 7,500 is claimed for the place. It is a busy, thriving city, and already gives support to several flouring mills, tanneries, etc.

VICE-PRESIDENT AND SECRETARY E. D. JOHNSTON, of the P. H. & F. M. Roots Company, of Connersville, Ind., writing under date of the 17th inst., says: "We are now building, for the Consumers Gas Company of Chicago, an exhauster with engine, combined on same iron bed plate, which is to have a maximum capacity of 16,000,000 cubic feet per 24 hours. This exhauster will likely be called the 'Columbia Exposition,' as it will be the largest exhauster in the world; and, no doubt, the great Exhibition in 1893 will surpass anything of this kind ever given. The exhauster will prove a great attraction to gas men who visit the Exhibition in 1893."

THE proprietors of the Columbus (Ohio) Gas Light and Coke Company have suggested to the Board of Public Works the propriety of causing the policemen to light and extinguish the public gas lamps still remaining in the city. There are not over 120 lamps now in duty, and the lighting and extinguishing of these under the present arrangement puts the city to an annual expenditure of $1,500.

IN the suit of Joseph Stelwagon's Son, of Philadelphia, who asked for an injunction restraining the Gas Bureau from entering into a contract with M. Ehret, Jr., & Co., for the tar produced on the municipal gas works, for a term of three years, from July 1, 1891, at the rate of 35 cents per ton of coal carbonized, whereas Stelwagon offered 36½ cents, was decided in favor of defendant. Judge Thayer ruled that it was not the province of the Court to interfere in the functions of the city officials under the law, unless the plaintiff alleged fraud or dishonest practice. In this particular instance no such allegation was made, hence no injunction would issue.

MR. R. M. JACKS has been appointed Superintendent of the Rochester (Minn.) Gas Light Company.

LAST week we gave the names of the Directors chosen to manage the consolidated gas interests of Rochester, N. Y. The other officers are: President, Mortimer F. Reynolds; Vice-President, William G. Runkle; Treasurer, H. G. Runkle.

THE meeting for the election of officers in the Austin (Tex.) Gas Light and Coal Company has been postponed to May 13.

THE Hamilton (Ont.) Electric Light Company's plant and franchises were, in accordance with the published notices, offered for sale at auction, on the 15th inst., by Thomas Burrows, acting for R. M. Wanzer. The first bid was $50,000, followed by an offer of $55,000, both offered by local capitalists. The representative of a New York syndicate then took voice in the sale, and a three-cornered duel resulted in a tedious battle, and the contention, which was not animated, dragged along until the figure of $91,500 was reached. The auctioneer failed to bring out an advance on this, whereupon Solicitor McKenzie instructed the auctioneer to withdraw the property. Mr. Wanzer's reserve price was $100,000.

THE following correspondence explains itself: "Cincinnati, Ohio, April 20, 1891.—Dear JOURNAL: One of the happiest affairs that it has been the good fortune of the writer to take part in was the occasion of the celebration of the silver wedding of Mr. and Mrs. Henry Felt. As everybody connected with the gas business is well aware, Mr. Felt is Superintendent of Distribution for the Cincinnati Gas Light and Coke Company, and a capable Snperintendent he is. Their handsome residence, on Elysium street, Bellevue Heights, was thrown open to the guests, whose invitations announced that the happy couple would, at 8 P.M. of the 18th inst., welcome their friends with heartiness. On the evening in question at least 150 responses in person to the invitations were made. The large hall and double parlors, profusely decorated with plants and flowers, were in appearance a beautiful bower, which illusion was further heightened by the fact that the orchestra, placed at one end of the hall, discoursed sweet strains while the performers were all but hidden from view by an environment consisting of palm and fern banks. Having paid our respects to our bluff and cheery host, and congratulated his charming wife on this happy rounding out of a quarter of a century of wedded harmony, dancing, gossip, and perhaps some flirtation were indulged in. When time's warning told of the midnight hour the hosts and guests adjourned to the dining room, there to be surprised again. Three large tables, forming a perfect horseshoe, fairly borne down with a weight of good cheer, the entire hall illuminated by 60 odd gas jets, to say nothing of the beaming faces of the brilliant company, produced an effect at once enlivening and beautiful. Addresses of congratulation were made by the Reverend Edward Voss, by Mr. Charles Siebler, of the Victoria Building Association, No. 1, and by Colonel John Hoban, of the Cincinnati Gas Company—the last named gentleman has been a co-laborer of Mr. Felt for more than 30 years. The presents were elegant and numerous—some of the most notable gifts

came from New York, Philadelphia and St. Louis. The entire Board of Directors of the Victoria Building Association, No. 1, of which organization Mr. Felt is President, and which, by the way, is the oldest Building Association in Cincinnati, graced the occasion with their presence. Their gift to their worthy President was indeed a noble one. The A. P. A. Maenaerchor lent effective aid to the festivities by rendering some excellent vocal music, and a very happy address by Mr. Henry Stothfang was a feature. 'Yawcob Straus' version of 'Is Marriage a Failure?' contributed greatly to the merriment of the guests, because of its appropriate rendering. Not until the bright sun of early dawn sent its rays over the eastern hills did the company take leave of their hosts, with heartiest wishes for the happy couple whose quarter century of married life had been so fittingly celebrated. Long may they live amid happiness and prosperity.—NON EST."

AT a special meeting of the Directors of the Pawtucket (R. I.) Gas Company, called to make a suitable minute respecting their late fellow-member, Mr. Darius Goff, the following resolutions were unanimously adopted:

"*Resolved*, That in the death of Darius Goff, the last of the original Directors of this Company, and for many years a member of its Executive Committee, this Board recognizes the loss of a valuable and efficient adviser, one who was ever foremost in advancing the interests of the corporation, and to whose wise counsels and superior judgment very much of its present prosperity is due.

"*Resolved*, That we attend, as a body, the funeral, to be held in the Pawtucket Congregational Church, on the 17th inst.

"*Resolved*, That the foregoing be entered upon the records of this meeting, and a copy of the same be forwarded to the family of the deceased."

THE Borough Council of West Chester, Pa., do not seem disposed to act hastily in the matter of granting a charter to the promoters of the proposed fuel gas company. The latter is said to be not in any sense inimical to the interests of the present West Chester Gas Company.

THE Connelly Iron Sponge and Governor Company has received an order for 10,000 bushels of iron sponge, to be delivered at the ninth ward gas works, 23d and Market streets, Philadelphia, Pa. This is the largest single order ever received by any manufacturer of iron sponge in this country.

THE hearing on the application of certain gas consumers of Boston to the Board of Gas and Electric Light Commissioners of Massachusetts, to compel the Boston Gas Light Company to reduce its selling rate, has again been postponed. The adjourned hearing is set for to-morrow, and the case has now been adjourned for the third time. It looks a bit like trifling with the good nature of the Commissioners, else the complainants or petitioners are simply indulging in trifling with the law. They should be brought to a sense of their position without delay.

THE amended ordinance permitting the Alton (Ills.) Gas and Electric Light Company to erect additional plant has been passed by the City Council.

THE proprietors of the Rapid City (S. D.) Gas Company have been as good as their word, in that gas is now being supplied from the works which were completed something over a fortnight ago. The people are very much pleased with the light, which averages 20-candle power.

FROM a local source we learn that the new electric light plant of the Louisville Gas Company, which is being erected at 14th and Magazine streets in that city, will be the largest of the kind south of the Ohio river—the apparatus is furnished by the Fort Wayne Electric Company. Chief Engineer Barret, of the Gas Company, assisted by Architect Drach, is directing the work. The foundations for the power house are completed and the buildings proper are well under way. Mr. Barret estimates that the plant will be in readiness to furnish light of the electric variety, in any volume demanded, by August 1st.

THE Nationalist Club, of Philadelphia, recently held a meeting, at which Dr. J. J. Taylor—who is a somewhat erratic gentleman—read a paper on the manufacture and supply of gas, as carried on in the Quaker City. The paper, which was put together in better shape than such compilations usually are, was followed by an animated discussion, in which it was asserted that the practice of the city in deriving a profit from the manufacture of gas was unfair and unjust. It was held, while the city reserved the exclusive right to supply gas, thus establishing an impregnable monopoly, it was her duty to sell it to consumers at the bare cost of production and distribution. The further point was made that this policy would encourage the use of gas as a fuel, resulting in cleaner and healthier homes and giving far greater benefit than the trifling abatement in taxes allowed by the profit from the manufacture of gas. The meeting was largely attended, and the proceedings were characterized by animation. Further, the discussion really followed (in the main) reasonable lines.

THE City Council, of Ocean City, N. J., recently passed an ordinance authorizing the proprietors of the Ocean City Light, Heat and Power Company to manufacture and distribute gas and electric currents in the city for lighting, heating and power purposes. Mr. J. C. Adams, a prominent real estate agent of Atlantic City, is President of the Company, and J. T. Adams, of Ocean City, is Secretary. The company is capitalized in $140,000, and the gas works will be put up at once.

THE Committee on Manufactures, Massachusetts Legislature, have reported unanimously bills to permit the towns of Danvers, Hingham, Peabody, Melrose and Marblehead to erect and maintain electric light plants. On the other hand the Committee reported unanimously leave to withdraw on the petition of the Boston Common Council for a law to enable Boston to anjoy the same privilege.

AN interesting case, involving the powers and duties of electric light companies, was recently on trial before Judge Norton, in the Supreme Court, Boston. The plaintiff is Mrs. Delana Shipley, who sues the Edison Electric Light Company. Complainant, who owns a factory on Kingston street, avers that the defendant refuses to supply her with light, and accordingly asks the court to compel it to supply her with electricity from its street plant. Plaintiff asserted that she had appealed to the Gas Commissioners for a compulsory order, which had been issued but had not been obeyed by defendant. The latter, in defense of its refusal, claimed that the lamps in her building were of the Perkins type, and that under its license from the parent Edison Company it was debarred from furnishing current to other than Edison lamps. Defendant also claimed that the statute under which the Gas Commissioners acted is invalid. The plaintiff holds that the limitation in the defendant's license is void, and that if a company has been given a right to lay wires in the public streets, it must furnish to all or none. Mr. E. R. Chaplin represents the plaintiff.

THE Brockton (Mass.) authorities have determined that hereafter the public lights are to be maintained from dusk to daylight.

AT the annual meeting of the stockholders of the Rome (N.Y.) Gas Light Company the following Directors were elected; J. D. Higgins, H. G. Utley, T. H. Stryker, Calvin Petrie, W. R. Huntington, E. H. Walworth and J. J. Norton.

AT the annual meeting of the Chuctanunda Gas Light Company, of Amsterdam, N. Y., the following officers were elected: President, S. Sanford; Secretary, Davis W. Shuler; Treasurer, D. D. Cassidy; Directors, Stephen Sanford, John McClumpha, Davis W. Shuler, D. D. Cassidy, John K. Stuart, John Kellogg and David Cady. The quantity of gas sent out last year is returned at 16½ millions cubic feet, and the unaccounted-for gas (according to the figures sent us) is reported at 25 per cent. A dividend of 5 per cent. was declared. While the correspondent who forwards the figures is a reliable man, we are nevertheless inclined to the belief that a slip has occurred in reporting the unaccounted-for gas account. If by any possibility it is accurately stated, then the Amsterdam folks ought to lose no time in going over their distributing system. The money so invested would be well spent. To paraphrase the Granger squib of years ago, "Gas is made to be used and not to be wasted."

THE proprietors of the Framingham Gas, Fuel and Power Company, of South Framingham, Mass., have arranged with Miss Barrows to give a series of lectures illustrated by means of practical cooking with gas, at the Union Hall, on the value and economy of gas as a domestic agent. Two of the lectures have been rendered, and Miss Barrows acquitted herself with such tact and skill that the Company already feels the results in the shape of an active inquiry for gas cookers.

THE electric annex of the Schenectady (N. Y.) Gas Light Company has been enlarged by the placing of a new engine (135 horse power) and dynamo. The Company is thus enabled to maintain 50 additional arc lights.

ELSEWHERE we noted the withdrawal of the plant and franchises of the Hamilton (Ont.) Electric Light Company from auction sale, because of failure to obtain the reserve price—$100,000. Since that failure we are informed that the property was purchased by a syndicate composed of Toronto, Montreal and Hamilton capitalists, whose offer of $92,000 was accepted by the former owners. The purchasers will expend $50,000 in betterments, a large portion of which will go into the equipment of an incandescent supply.

AS a result of the consolidation at Rochester, N. Y., General Manager R. L Cole has been authorized to announce that on and after May first the gross rate will be put at $1.60 per 1,000 cubic feet, prompt payment to entitle consumers to a rebate of 20 cents per 1,000. This is equivalent to a reduction of 20 cents.

AT the annual meeting of the Saco and Biddeford (Me.) Gas Light Company the following officers were chosen: President, Enoch Lowell; Treasurer, Jerry G. Shaw; Directors, E. Lowell, J. G. Shaw, L. Bryant, R. Jordan and G. P. Wescott.

THE San Jose (Cal.) Light and Power Company will bond its plant in $60,000, the proceeds to be used in enlarging the capacity of its present gas and electric plants.

THE AMERICAN GAS LIGHT JOURNAL

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PROPRIETORS.

EDITOR—JOS. R. THOMAS, C.E.
ASST. EDITOR—T. J. CUNNINGHAM.
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AGENTS.

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MONDAY, APRIL 27, 1891.

The Market for Gas Securities.

The market for city gas shares was steady to strong during the week, Consolidated holding its own, with fairly good inquiry for it. The opening price to-day (Friday) was 99 bid. Mutual was asked for by strong parties, but no trading is reported, bidders refusing to go above 119, while holders were equally stubborn in their demands for 121. These shares look like a purchase. The Company has called in $100,000 bonds, interest on which is to cease May 1st.

Brooklyn shares are dull and strong. We note sales at auction of 35 shares Fulton Municipal, at 130½, and 10 shares Metropolitan, of Brooklyn, at 103. Chicago gas is very buoyant, and it would not surprise us at all to see those shares go to 60; for there is good reason for presuming that holders will receive the deferred dividend in addition to the one shortly to be declared. It is a certainty that the money has been more than earned. Baltimore is a shade off, and Bay State is firmer, 62½ being freely bid for it. Bond issues are sought for, and 110 is quoted with great frequency for Metropolitan, of New York. Poughkeepsie gas is in demand, and insiders are those most anxious to secure it. The general situation is favorable to holders.

Advertisers Index.

GAS ENGINEERS. Page
Jos. R. Thomas, New York City ... 617
Wm. Henry White, New York City ... 623
Fred. Bredel, N. Y. City ... 619

CHEMISTS.
Durand Woodman, New York City ... 617

GAS AND WATER PIPES.
Mellert Foundry and Machine Co., Reading, Pa. (John Fox, Selling Agent, N. Y.) ... 617
Ohio Pipe Co., Columbus, Ohio ... 617
M. J. Drummond, New York City ... 617
R. D. Wood & Co., Phila., Pa ... 622
Warren Foundry & Machine Co., New York City ... 617
Donaldson Iron Co., Emaus, Pa ... 617
Gilbert & Barker Mfg. Co., New York City ... 617

PROCESSES.
National Gas Light and Fuel Co., Chicago, Ills ... 614
Bartlett, Hayward & Co., Baltimore, Md ... 621
United Gas Improvement Co., Phila., Pa ... 613
Burdett Loomis, Hartford, Conn ... 610
American Gas, Light and Heat Co., Phila., Pa ... 610

GAS WORKS APPARATUS AND CONSTRUCTION.
James R. Floyd & Sons, New York City ... 623
Continental Iron Works, Brooklyn, N. Y ... 623
Delly & Fowler, Phila., Pa ... 623
Kerr Murray Mfg. Co., Fort Wayne, Ind ... 620
Stacey Mfg. Co., Cincinnati, Ohio ... 623
Bartlett, Hayward & Co., Baltimore, Md ... 621
Morris, Tasker & Co., Limited, Phila., Pa ... 621
Davis & Farnum Mfg Co., Waltham, Mass ... 620
R. D. Wood & Co., Phila., Pa ... 622
Bouton Foundry Co., Chicago, Ills ... 623
Isbell-Porter Company, New York City ... 622
Fred. Bredel, N. Y. City ... 619
United Gas Improvement Co., Phila., Pa ... 613
National Gas Light and Fuel Co., Chicago, Ills ... 614
Berlin Iron Bridge Company, East Berlin, Conn ... 610

INCLINED RETORTS.
Laclede Fire Brick Manuf'g Co., St. Louis, Mo ... 571

GASHOLDER TANKS.
W. C. Whyte, New York City ... 614
J. P. Whittier, Brooklyn, N. Y ... 615

GASHOLDER PAINT.
The Government Waterproof Paint Co., Boston, Mass ... 610

RETORTS AND FIREBRICK.
J. H. Gautier & Co., Jersey City, N. J ... 618
B. Kreischer & Sons, New York City ... 618
Adam Weber, New York City ... 618
Laclede Fire Brick Manuf'g Co., St. Louis, Mo ... 618
Brooklyn Retort and Fire Brick Works, Brooklyn, N. Y ... 618
Borgner & O'Brien, Phila., Pa ... 618
James Gardner, Jr., Pittsburgh, Pa ... 618
Henry Maurer & Son, New York City ... 619
Chicago Retort and Fire Brick Co., Chicago, Ills ... 618
Baltimore Retort and Fire Brick Co., Baltimore ... 618
Oakhill Gas Retort and Fire Brick Co., St. Louis, Mo ... 618
Boston Fire Brick Works, Boston, Mass ... 618

SCRUBBERS AND CONDENSERS.
G. Shepard Page, New York City ... 574
R. D. Wood & Co., Phila., Pa ... 622
James R. Floyd & Sons, New York City ... 616
Continental Iron Works, Brooklyn, N. Y ... 623

REGENERATIVE FURNACES.
Bartlett, Hayward & Co., Baltimore, Md ... 621
Fred. Bredel, New York City ... 619
Chicago Retort and Firebrick Co., Chicago, Ills ... 618
J. H. Gautier & Co., Jersey City, N. J ... 619
Adam Weber, New York City ... 608

GAS GOVERNORS.
Connelly Iron Sponge and Governor Co., New York City ... 615
Fred. Bredel, N. Y. City ... 619
Friedrich Lux, London, England ... 608
Wilbraham Bros., Phila., Pa ... 615

SELF-SEALING MOUTHPIECE DOORS.
Ibsell-Porter Company, New York City ... 622
Continental Iron Works, Brooklyn, N. Y ... 609

TAR AND CARBONIC ACID EXTRACTOR.
Geo. Shepard Page, N. Y. City ... 610

CEMENTS.
C. L. Gerould & Co., Brooklyn, N. Y ... 618

GAS METERS.
John J. Griffin & Co., Phila., Pa ... 626
American Meter Co., New York and Philadelphia ... 627
The Goodwin Gas Stove and Meter Co., Philadelphia, Pa ... 627
Helme & McIlhenny, Phila., Pa ... 627
D. McDonald & Co. Albany, N. Y ... 627
Nathaniel Tufts, Boston, Mass ... 626
Maryland Meter and Manufacturing Co., Baltimore, Md ... 626
Harris Bros. & Co., Philadelphia, Pa ... 626

EXHAUSTERS.
The P. H. & F. M. Roots Co., Connersville, Ind ... 612
Isbell-Porter Company, New York City ... 622
Wilbraham Bros., Philadelphia, Pa ... 615
Connelly Iron Sponge and Governor Co., New York City ... 615

GAS COALS.
Penn Gas Coal Co., Phila., Pa ... 625
Perkins & Co., New York City ... 624
Despard Coal Co., Baltimore, Md ... 625
Chesapeake and Ohio R. R. Coal Agency, N. Y. City ... 625
Westmoreland Coal Company, Phila., Pa ... 625
J. & W. Wood, New York City ... 624

CANNEL COALS.
Perkins & Co., New York City ... 624
J. & W. Wood, New York City ... 624

ANTHRACITE COALS.
Coxe Bros. & Co., New York City ... 625

GAS ENRICHERS.
Standard Oil Co., Cleveland, Ohio ... 624

VALVES.
Ludlow Valve Manufacturing Co., Troy, N. Y ... 607
Chapman Valve Manufacturing Co., Boston, Mass ... 607
R. D. Wood & Co., Phila., Pa ... 622
The P. H. & F. M. Roots Co., Connersville, Ind ... 612
Gilbert & Barker Mfg. Co., New York City ... 617
Continental Iron Works, Brooklyn, N. Y ... 623

GAS ENGINES.
Schleicher, Schumm & Co., Phila., Pa ... 592
Clerk Gas Engine Co, Phila., Pa ... 625

ENGINES AND BOILERS.
Jarvis Engineering Co., Boston, Mass ... 615
Westinghouse Machine Co., Pittsburgh, Pa ... 617

GAS LAMPS.
Fiske, Coleman & Company, Boston, Mass ... 618

PURIFIER SCREENS.
John Cabot, New York City ... 608

GAS STOVES.
American Meter Co., New York and Philadelphia ... 611
The Goodwin Gas Stove and Meter Co., Phila. Pa ... 628
George M. Clark & Company, Chicago, Ills ... 608
D. McDonald & Co., Albany, N. Y ... 627
Maryland Meter and Manufacturing Co., Baltimore, Md ... 626
Chicago Gas Stove Company, Chicago, Ills ... 608
Dangler Stove and Mfg. Co., Cleveland, O ... 609

BURNERS.
C. A. Gefrorer, Phila., Pa ... 624
Moses G. Wilder, Phila., Pa ... 607
H. W. Rappleye, Phila., Pa ... 607

STREET LAMPS.
J. G. Miner, Morrisania, New York City ... 607
Bartlett Street Lamp Mfg. Co., New York City ... 607

STEAM BLOWER FOR BURNING BREESE.
H. E. Parson, New York City ... 608

PURIFYING MATERIAL.
Connelly Iron Sponge and Governor Co., New York City ... 615
Friedrich Lux, London, England ... 608
Greenpoint Chemical Works, Brooklyn, N. Y ... 615

COKE CRUSHER.
C. M. Keller, Columbus, Ind ... 625

ELECTRICAL APPARATUS.
Wm. Henry White, N. Y. City ... 623
Fort Wayne Electric Co., Fort Wayne, Ind ... 616

BOOKS, ETC.
1890, Directory, 1890 ... 615
King's Treatise ... 617
Electric Light Primer ... 625
American Gas Engineer and Superintendents' Handbook ... 619
Digest of Gas Law ... 607
Fuel and its Applications ... 607
Newbigging's Handbook ... 619
Scientific Books ... 268

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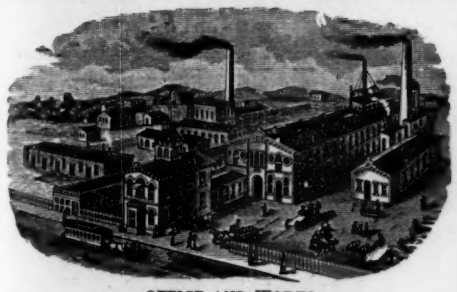

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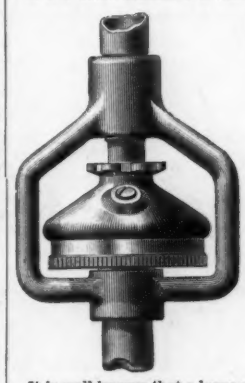

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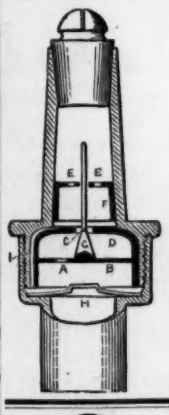

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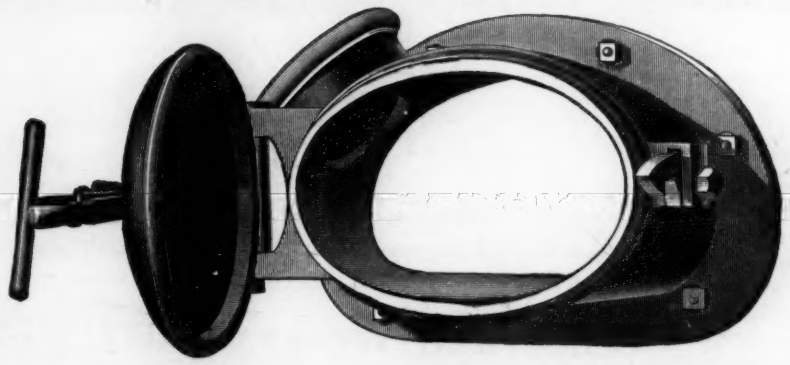

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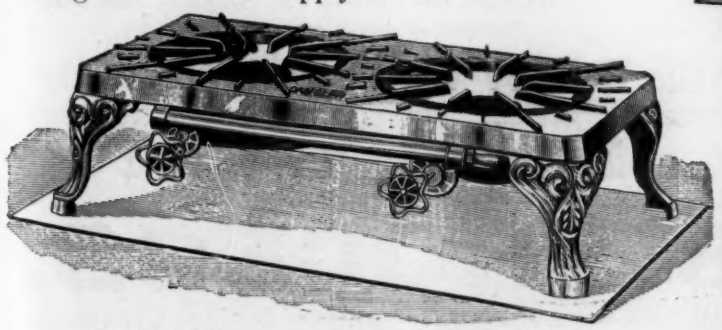

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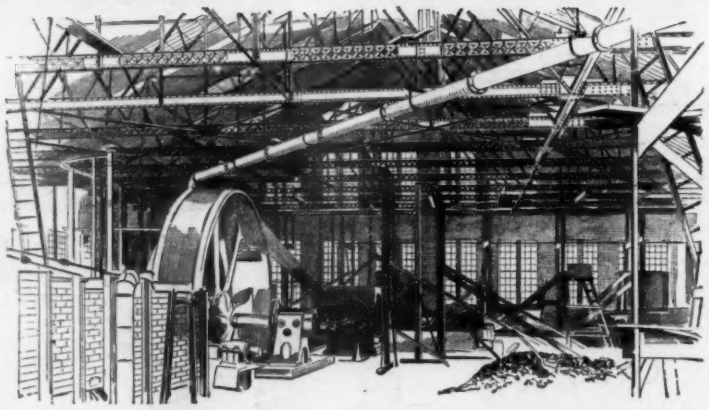

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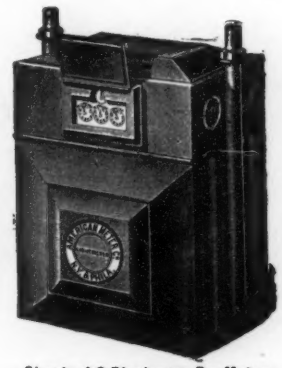

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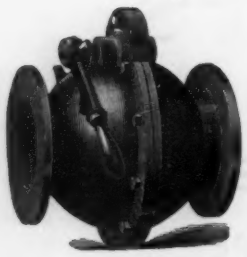

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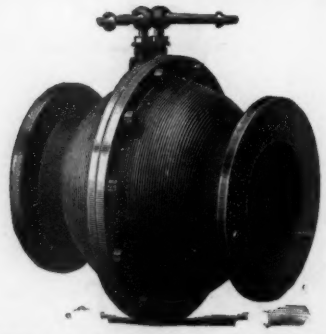

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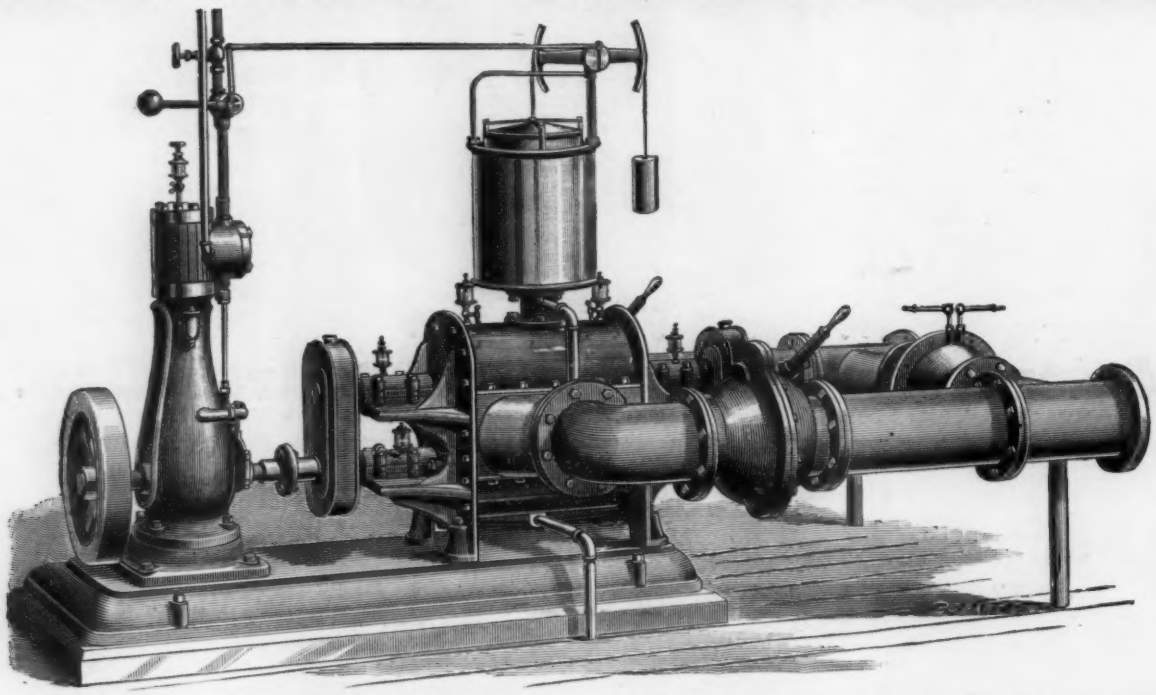

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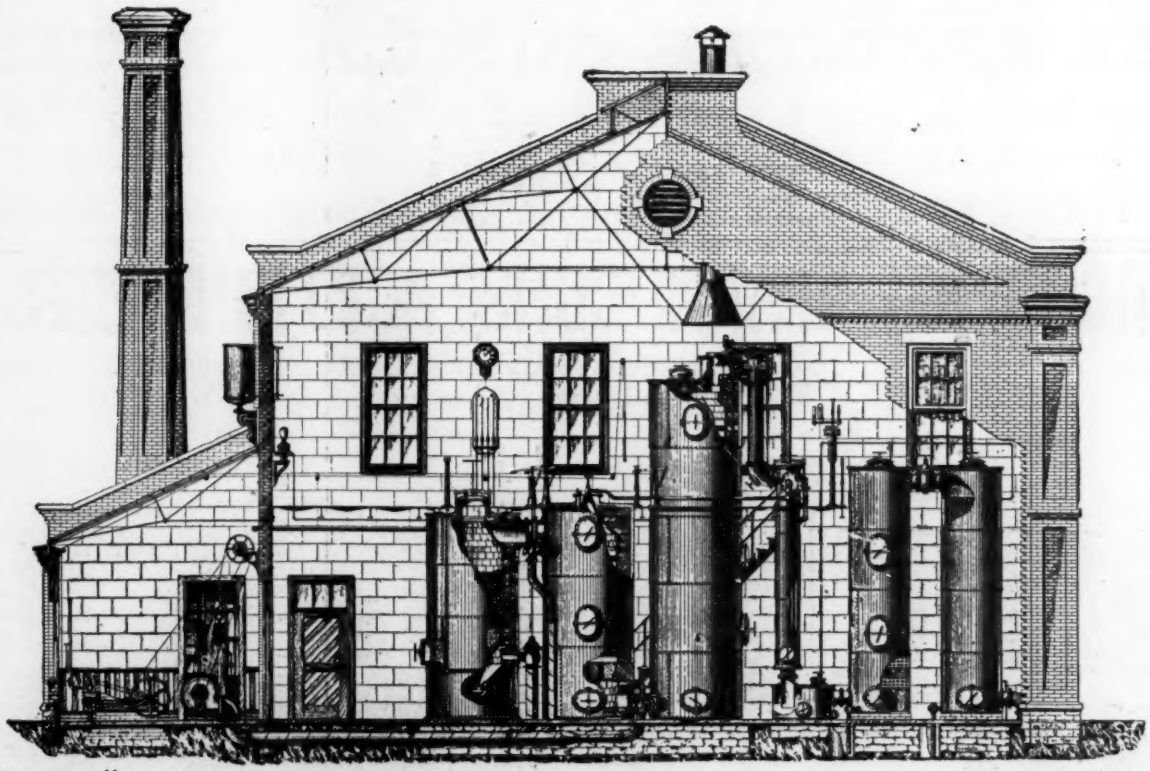

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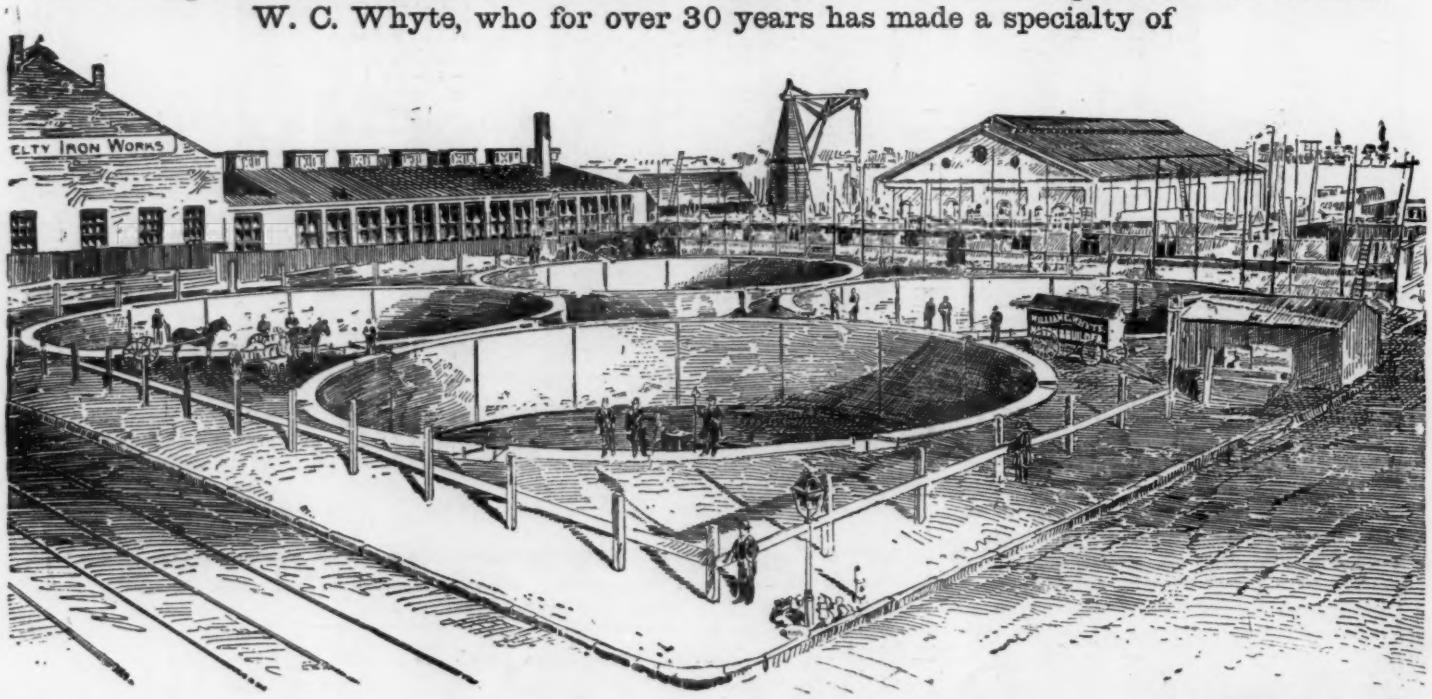

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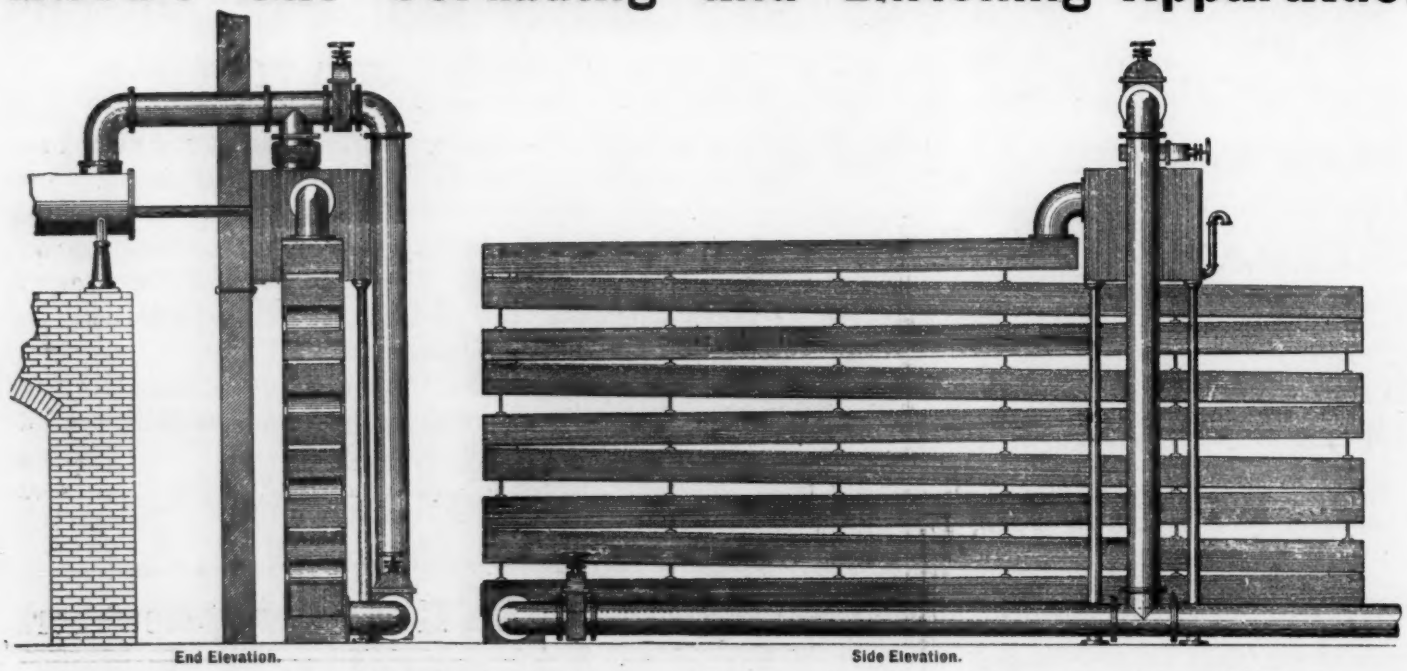

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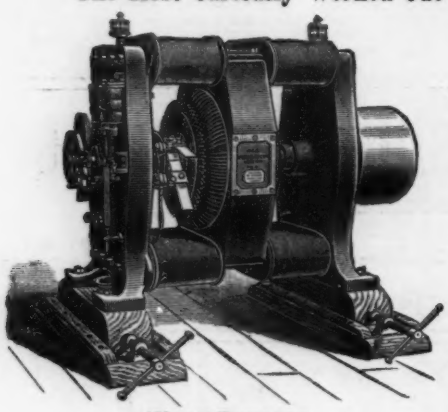

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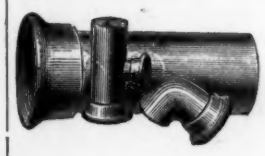

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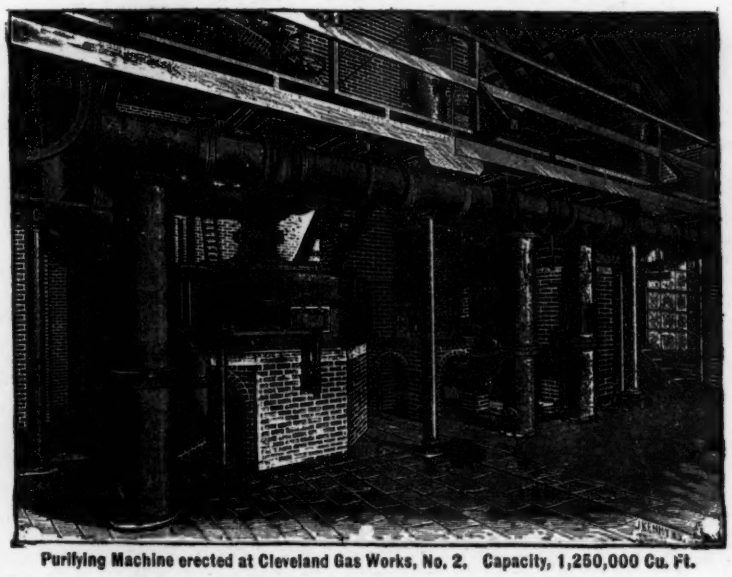

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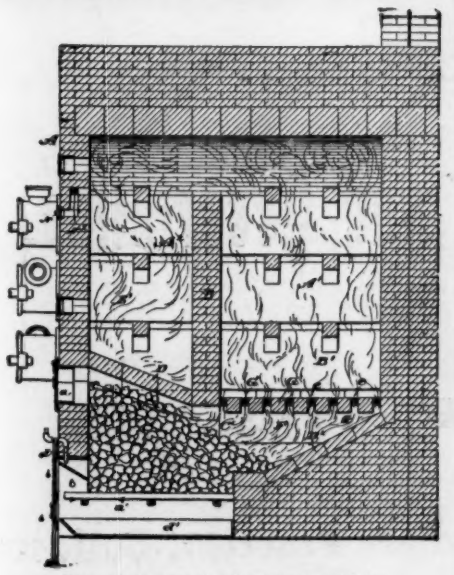

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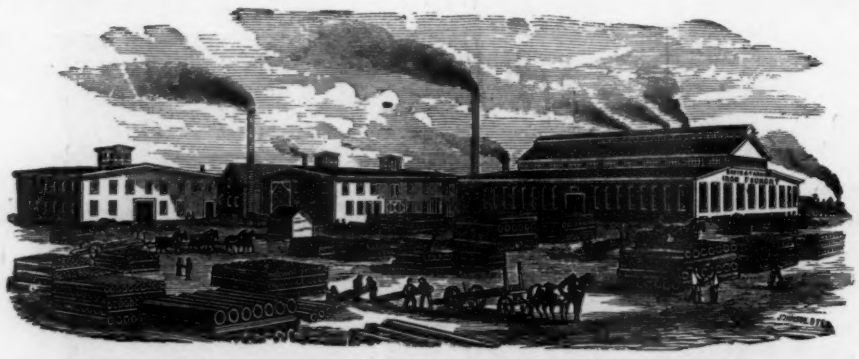

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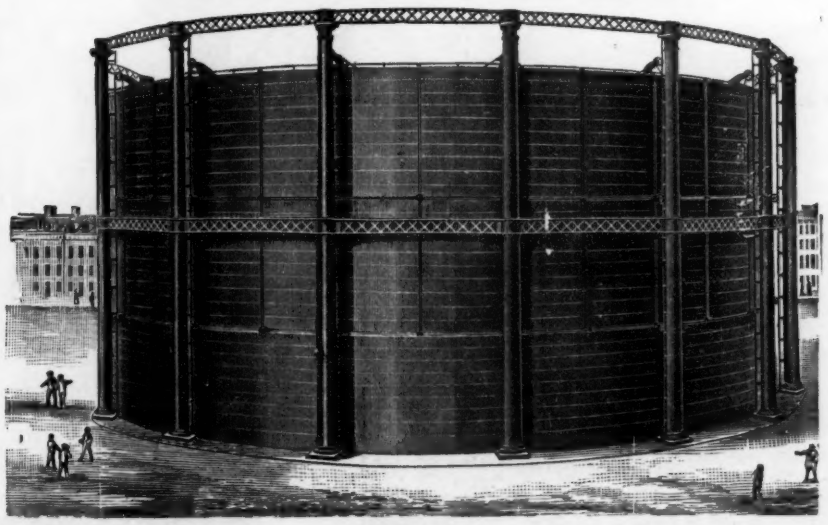

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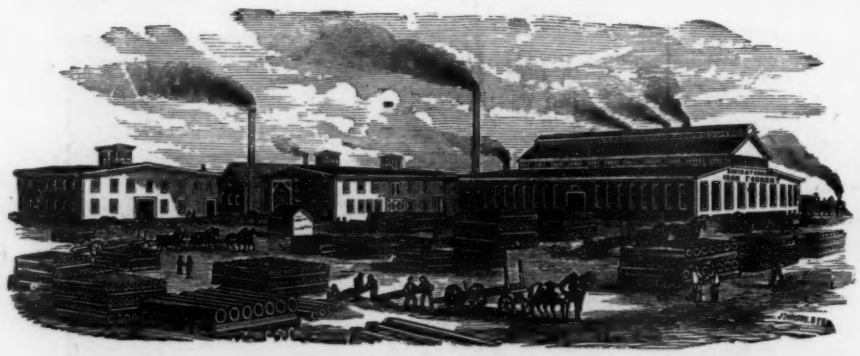

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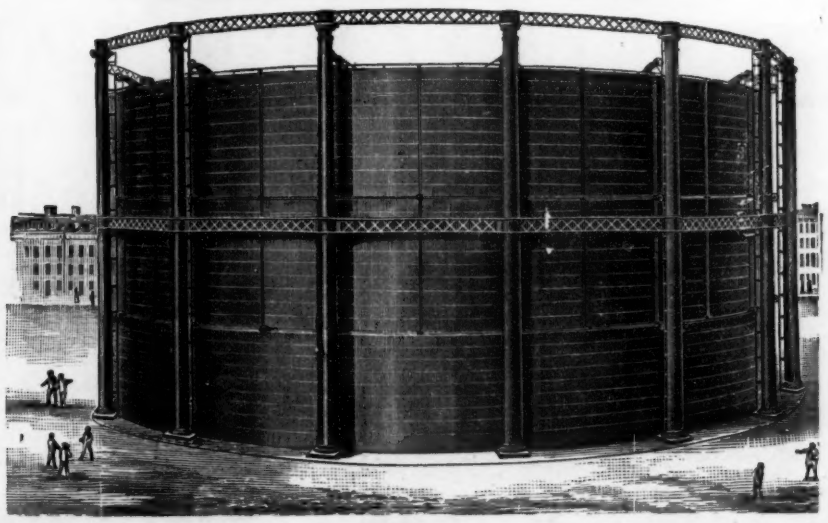

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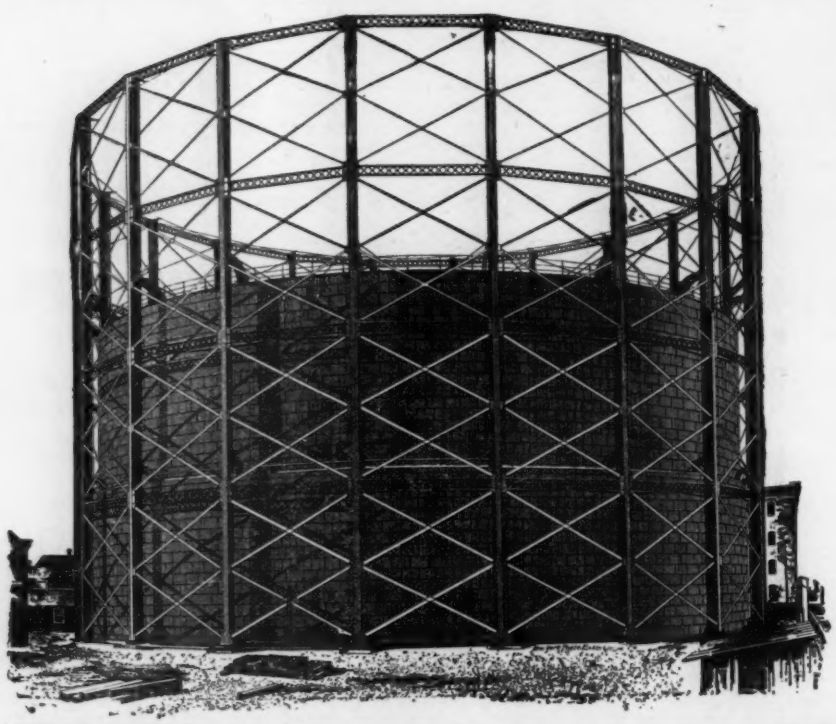

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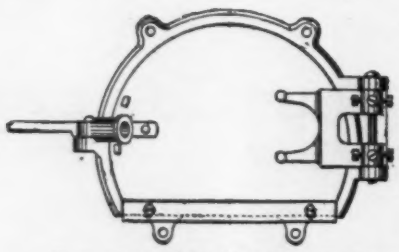

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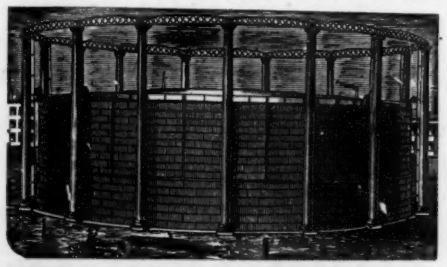
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This Colliery is located at SCOTT HAVEN, PA., in the center of the Youghiogheny Gas Coal District, and produces the ONLY RELIABLE YOUGHIOGHENY COAL for gas purposes. (See Map on p. 87 of this JOURNAL, Feb. 16, '85.)

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} equal to { 750,000 Candle Feet of Gas, and 26 Bushels of merchantable Coke weighing 900 Pounds

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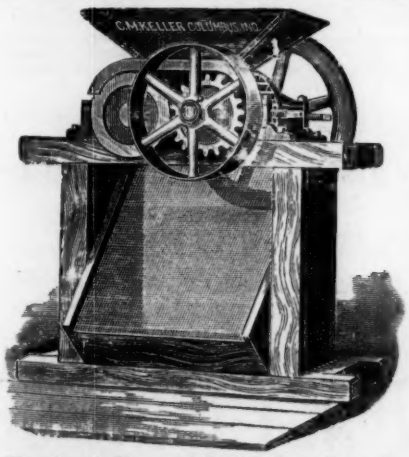

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Mines situated on the Pennsylvania and the Baltimore and Ohio Railroads, in Westmoreland County, Penn.

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The utility and convenience of the Gas Engine being no longer an open question, it only remains now for intending purchasers to select the BEST. We claim for the CLERK GAS ENGINE that it is equal to any other manufactured as regards steadiness in running, simplicity, and ease of keeping in repair, and that it gives the greatest amount of power for the least money (both in first cost and expense of running) of any engine made. In support of this claim we refer to the test of the Gas Engines made under the direction of the American Institute of New York, in December, 1885, and heretofore published in these columns. These engines are especially adapted for continuous running under heavy loads, and we can refer to Engines which have run 22 hours a day for months at a time

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Center Seals, Pressure Registers, Governors, Indicators, Photometers, and all other kinds of Apparatus for use in Gas Works.

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Station Meters (square, cylindrical, or in staves), Glazed Meters, King's and Sugg's Experimental Meters, Lamp Post Meters, etc., etc. Meter Provers (sizes 2, 5, and 10 feet), Pressure Gauges of all kinds, Pressure Registers, Pressure and Vacuum Registers, Pressure Indicators (sizes 4, 6, and 9 inch); King's Pressure and Vacuum Gauges, Dry and Wet Center Seals, Dry and Wet Governors, Exhauster Governors, Photometers of all descriptions. Letheby's Sulphur and Ammonia Test Apparatus complete. Also, Testing and Chemical Apparatus of all kinds, and of the most perfect description, for all purposes relating to Gas.

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We use only the very best materials, and employ the most skilled labor, and by our long experience (36 years) and personal supervision of every detail we fee justified in assuring the public that our goods will give perfect satisfaction. Every Meter emanating from our establishment will bear the State Inspector's BADGE, and will be fully warranted by us. Our Annual and Calendar will be sent to Gas Companie upon application.

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"SUN DIAL" GAS STOVES,

The Most Economical, Efficient, and Durable Gas Stove Made.

GAS COOKING STOVE, No. 8 C.

SIZE.

Stove.	Oven.	Roaster.	Top.	Length over Extension Shelves,
37 in. high.	12 in. high.	12 in. high.	24 in. long.	36 in.
20 in. wide.	17½ in. wide.	18 in. wide.	21 in. wide.	
	12 in. deep.	13 in. deep.		

This Stove has four burners on top, and double oven burner.

Consumption of gas with all burners in use, 42 feet per hour, at 1 inch pressure.

The top is made in sections, so that a greater variety of cooking utensils may be used. By lifting out the covers and crosspieces and putting in a suitable forked ring, which is sent with each stove, a wash boiler or other large utensil may be set over two burners. Our **No. 87 GRIDDLE** also fits in the same position. The roasting oven is provided with a cast-iron door.

All Fittings are Nickel-Plated.

GAS COOKING STOVE, No. 7 B.

SIZE.

Stove.	Oven.	Roaster.	Top.	Length over Extension Shelves,
31 in. high.	9½ in. high.	10 in. high.	21 in. long.	32 in.
17 in. wide.	14½ in. wide.	15 in. wide.	16 in. wide.	
	12 in. deep.	13 in. deep		

This Stove has three boiling burners in the Top or Hot Plate, and one single oven burner.

This cut represents our New Style Cooking Stove. As will be seen, it has an ornamented cast-iron Base and Front, and extension shelves. The Oven Burner, which is atmospheric (unless otherwise ordered), is of an entirely new and improved pattern (patent). The ovens are of greater capacity than those of the old style. The Top, in conjunction with the Outlet Pipe, is designed to carry off all the products of combustion, if desired, but they are also supplied with a loose ring which converts it into an ordinary open top stove.

The consumption of this Stove is 35 cubic feet per hour at 1 inch pressure, with all Burners in use.

All Fittings are Nickel-Plated.

"RADIANT" BOILING STOVE, WITH REGENERATIVE BURNER.

Size, 6¼ inches diameter, 8 inches high. Consumption, 6 feet per hour at 1 in. pressure.

HOT PLATE, No. 111.

Size, 36 in. long, 12 in. wide, with three double burners, 6 taps.

Consumption, with all burners in use, 36 cubic feet per hour, with 1 in. pressure.

¼ in. supply pipe should be used where the pressure is 1 in. or over.